Humes

Strength. Performance. Passion.

AUSTRALASIA EPD
ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration

Humes Precast and Prestressed Concrete Products
In accordance with ISO 14025 and EN 15804
EPD Registration no. S-P-01545 | Version 1.0
Issued 2020-12-23 | Valid until 2025-12-23
Geographical scope: Australia

A Division of Holcim Australia

Contents

Programme 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 as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for precast and prestressed steel-reinforced concrete products manufactured at Humes' production facilities across 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.

Declaration Owner	**Holcim (Australia) Pty Ltd** Level 7, 799 Pacific Highway Chatswood NSW 2067, Australia Web: www.holcim.com.au Phone: +61 2 9412 6600	
EPD Program Operator	**EPD Australasia Limited** Address: 315a Hardy Street Nelson 7010, New Zealand Web: www.epd-australasia.com Email: info@epd-australasia.com Phone: +61 2 8005 8206	
EPD Produced by:	**start2see Pty Ltd** 309 / 2a Montrose Place Hawthorn East Vic 3123, Australia Web: www.start2see.com.au Email: Rob.Rouwette@start2see.com.au Phone: +61 403 834 470	

EPD registration number:	S-P-01545	**Version:**	1.0
Published:	2020-12-23	**Valid until:**	2025-12-23 (5 years)
Reference year for data:	2019-01-01 – 2019-12-31		

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, version 2.31, 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)
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

Prestressed Super-T girders

Humes

Humes is Australia's leading provider of engineered concrete solutions for the civil construction industry. Humes Concrete Products (Humes) is a division of Holcim (Australia) Pty Ltd which is owned by one of the world's largest building materials companies, 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 and prestressed products manufactured at all of Humes sites across Australia (Figure 1).

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.

Humes has been involved in many major projects through which the business has demonstrated an ability to deliver to client specifications. Humes' reputation is well established in the civil construction and engineering market as a valuable and reliable partner.

The quality and reliability of Humes' products and services are the foundation of our success.

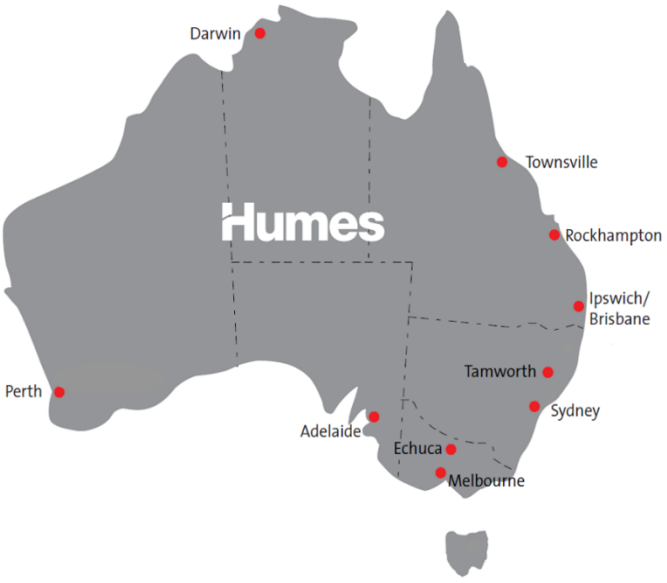


Figure 1: Location of Humes' precast and prestressed concrete production facilities

Product description

Humes offers a wide range of solutions, including but not limited to:

Stormwater solutions:

- Steel reinforced concrete pipes and fittings
- Box culverts (small)
- Headwalls, pits, kerb inlets and floodgates
- HumeGard® Gross Pollutant Trap
- HumeCeptor® hydrodynamic separator
- StormTrap® system
- RainVault® system

Sewage transfer and storage solutions:

- Steel reinforced concrete pipes with corrosion protection
- Access chambers/Manholes
- QuickTee® maintenance shafts
- Storage tanks
- Pump stations

Tunnel and shaft solutions:

- One piece shaft
- Segmental shafts
- Segmental tunnel linings
- 3-Pin arches

Bridge and Platform Solutions:

- Precast Arches
- HumeDeck® system
- Box culverts – large
- Uniculvert® modules
- Prestressed decks and girders
- HumeSlab® bridge decking

Walling and Traffic Management Solutions

- H-Wall® retaining wall
- L and T walls
- Grain bunker modules
- Barriers and wheel stops

Cable and Power management Solutions:

- Cable jointing pits and access chambers
- Costello pits
- Substation mounts

This EPD covers the vast majority of our product range. The only products that have been excluded are steel reinforced concrete pipes (these are covered by Humes EPD S-P-00998) and specialty products that contain significant quantities of other materials (i.e. metals other than reinforcing steel and various polymer materials) that are not covered in this EPD. Examples of such products are our standard HumeGard® and HumeCeptor® range as well as other products that can be lined. The concrete and reinforcement components of these example specialty products can be calculated by this EPD however these products contain a significant proportion of other materials like stainless steel, fibreglass and polyethylene that is not covered by this EPD.

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.

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). 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 and prestressed 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 precast and prestressed concrete products are manufactured to all relevant specifications in Australia. This includes but is not limited to Australian Standards and regional road authority specifications.

For more information on the Humes product range and compliance please see our product catalogues on our website (https://www.holcim.com.au/humes) or contact our sales team.

Table 1: Product content for precast concrete

Name	Proportion#	CAS
General purpose (GP) cement*	10 - 25%	65997-15-1
Aggregates containing crystalline silica** (quartz)	65 - 76%	14808-60-7
Water	<10%	7732-18-5
Fly Ash***	0-7%	69131-74-8
Slag***	0-8%	65996-69-2
Silica Fume***	0-2%	69012-64-2
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
Steel#	0-12%	7439-89-6

* 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.
# The proportion of concrete components denotes the mass percentage that is present in the concrete faction. The proportion reinforcement steel is measured as the mass percentage of steel in the reinforced concrete product.

Note: Grout or other materials may be used to fill gaps between units in their application. These materials are not included in the scope of this EPD.

Scope of Environmental Product Declaration

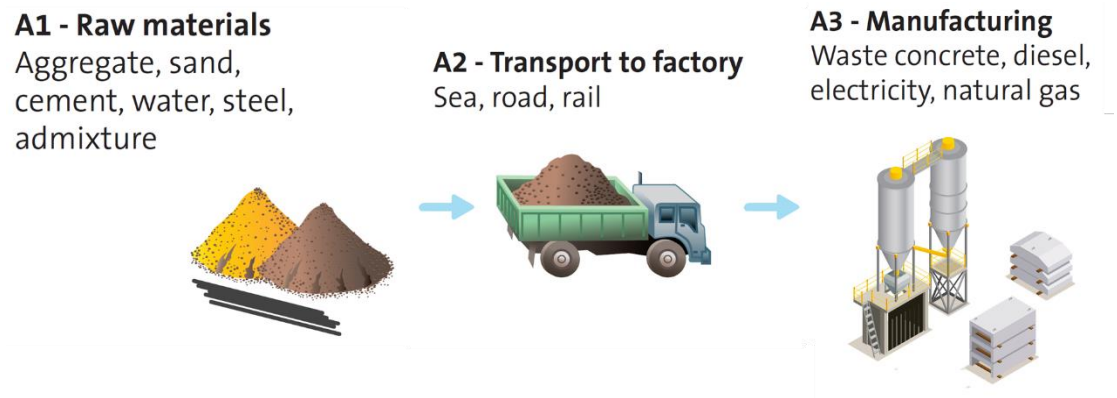
This EPD covers the cradle-to-gate life cycle stages A1-A3. Downstream stages have not been included as shown in Table 2 and Figure 2.

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 2: Cradle-to-gate life cycle of precast and prestressed concrete products



Product Stages

Raw Material Stage A1

All raw materials used in the production of Humes Concrete Products comply with (but not limited to) the following Australian Standards:

- AS/NZS 3972: General purpose and blended cements (SA 2010)
- AS 3582 Parts 1, 2 and 3 Supplementary cementitious materials (SA 2016)
- AS/NZS 4671 Steel reinforcing materials (SA 2019)
- AS 4672.1:2007 Steel prestressing materials (SA 2007)
- 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)

Transportation Stage A2

Raw materials are transported to our site via articulated trucks, rigid trucks, barges and rail. The impact of transportation is determined from the specific supply sources for each site.

Manufacturing Stage A3

The typical manufacturing process of Humes Concrete Products is by casting specially formulated concrete into a reusable steel mould. Compaction is predominantly achieved by utilising Self Compacting Concrete (SCC), a special type of concrete which can be placed and consolidated under its own weight without vibration; however where normal slumping concrete is required compaction is achieved by conventional external form and internal vibrators. 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.

Stormwater pits


Road barriers

Life Cycle Assessment (LCA) Methodology

Background Data

Primary data have been collected for the 2019 calendar year (CY2019) for all sites, with the exception of Tamworth for which data cover financial year 2019 (FY19) (1 July 2018 – 30 June 2019). They have been sourced directly from Humes' factories that manufacture precast and prestressed products. Background data have predominantly been sourced from AusLCI and the AusLCI shadow database. Data for reinforcing steel (bars, mesh, wire) have been sourced from our supplier's EPDs (registration numbers S-P-00855 v1.1, S-P-00857 v1.1, S-P-00858 v1.1) (InfraBuild 2020a-c) where we source steel from InfraBuild. At some locations we source reinforcement steel (bar, mesh, wire, strand) from other suppliers, who import the steel. As specific data on the supply chain are not publicly available, we have used ecoinvent v3 data to estimate the impacts of the various types of reinforcement steel. For transport of imported steel, we assumed shipping from Singapore to the concrete plant's closest major port. 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 and prestressed products produced by Humes in Australia, it was decided to present results separately for concrete and steel reinforcement on a mass basis. This allows the user to calculate the impacts of a product when the mass of concrete and steel reinforcement is given. We have included product tables for key products in this EPD. For other products, dimensions and compositions may vary by production location or state, and as a result no standard conversions are provided. Please contact your local Humes site for information on product composition if the product is not listed in this EPD.

The results are presented for each of our ten production locations. Locations will typically produce more than one mix-design, so we have presented multiple options for concrete mixes. Where we use different mix designs with similar cement content ($< \pm 10\%$ variation in kg/m^3 cement content), we have grouped these. The use of steel bar, mesh, wire, strand and galvanised bar is product specific. We provide an average environmental profile per kg of steel reinforcement per site. The differences between sites are the result of different shares of the type of reinforcement combined with differences in the supply chains.

This presentation format reduces the variation for each product's environmental profile, as it allows the user to calculate the environmental profile according to the exact product composition and manufacturing location.

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 slag: We applied economic co-product allocation, attributing 0.3% of the environmental impacts of pig iron production to the slag. Energy for drying and grinding slag into ground granulated blast furnace slag (GGBFS) are added separately.
- Use of silica fume: We applied economic co-product allocation, attributing 4.8% of the environmental impacts of metallurgical grade silicon production to the silica fume (Timm et al 2019).
- Use of steel scrap in reinforcement steel: Recycling allocation has followed the polluter pays principle in line with EN 15804 and the PCR. See InfraBuild's EPDs (S-P-00855; S-P-00857 and S-P-00858) of reinforcing products (InfraBuild 2020a-c).

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, 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 precast concrete products manufactured using normal slumping concrete and Self Compacting Concrete (SCC) by Humes in Australia. The concrete composition is taken from Humes's internal operating systems. Some (<10%) of concrete is supplied by neighbouring concrete plants that are not owned by Humes. We have used the exact concrete composition for both in-house manufactured and imported concrete.

Individual products may contain a combination of different types of reinforcement steel (bar, mesh, wire, strand, galvanised bar). We have used the weighted average type of steel per site to report reinforcement steel impacts.

Box culverts

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 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 and prestressed 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%.

Precast concrete products are generally manufactured using one or two routine concrete mixes. Our sites also have the ability to use high early strength mixes and project-specific mixes.

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

1 tonne of precast (or prestressed) reinforced concrete product.

After careful consideration, we determined that presenting the results for concrete and reinforcement steel separately would best limit any variations in environmental profiles while providing a clear pathway for users of the EPD to calculate the impacts per declared unit across hundreds of product permutations.

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 concrete mix designs (per tonne) and reinforcement steel (per kg) used at each site are presented in this section, for each of the following production sites:

- Sydney (Blacktown), NSW
- Tamworth, NSW
- Ipswich, QLD
- Rockhampton, QLD
- Townsville, QLD
- Melbourne (Laverton), Vic
- Echuca, Vic
- Adelaide (Pooraka), SA
- Perth (Welshpool), WA
- Darwin (Winnellie), NT

Examples of how to calculate the profile of a specific product

(Examples provided are for GWP. Repeat this process for each indicator.)

Product and production location	**Example 1: Small box culvert 1200 x 1200 x 2.4m, supplied from Pooraka in Adelaide**	**Example 2: Humes deck, 15m long, supplied from Townsville**
Step 1: Look up the product composition in the Product Specifications section (from page 26); or consult your local Humes supplier for the product's compositional details if not included in this EPD.	Small box culverts are found in table 19, which shows a 1200 x 1200 product contains 1.05 m^3 of concrete and 79 kg of steel reinforcement.	Humes decks are found in table 16, which shows a 15m long deck contains 5.11 m^3 of concrete and 324 kg of steel reinforcement and 283 kg steel strand.
Step 2: Ask your Humes supplier which mix design is used for your products. The default is *Routine Mix*.	Check density for the relevant mix (first row of table 12 for Adelaide (Pooraka) routine mix): 2400 kg/m^3	Check density for the relevant mix (first row of table 9 for Townsville routine mix): 2380 kg/m^3
Step 3: Look up the environmental profiles for the concrete and steel for the supplying site in the tables on the following pages.	Adelaide (Pooraka) is shown in table 12: Routine mix: 2.35E+02 kg CO_2e/t Reo steel: 1.18E+00 kg CO_2e/kg	Townsville is shown in table 9: Routine mix: 2.21E+02 kg CO_2e/t Reo steel: 1.74E+00 kg CO_2e/kg Strand steel: 3.19E+00 kg CO_2e/kg
Step 4: Multiply the volume of concrete by the density of the concrete mix and the environmental indicator values for the concrete. For steel, multiply the quantity of steel by the environmental indicator values for steel.	Concrete: 1.05 m^3 x 2.4 t/m^3 x 2.35E+02 kg CO_2e/t = 5.92E+02 kg CO_2e Steel: 79 kg x 1.18E+00 kg CO_2e/kg = 9.32E+01 kg CO_2e	Concrete: 5.11 m^3 x 2.38 t/m^3 x 2.21E+02 kg CO_2e/t = 2.69E+03 kg CO_2e Reo steel: 324 kg x 1.74E+00 kg CO_2e/kg = 5.64E+02 kg CO_2e Strand: 283 kg x 3.19E+00 kg CO_2e/kg = 9.03E+02 kg CO_2e
Step 5: Add the concrete and steel results to get to the reinforced concrete product.	5.92E+02 + 9.32E+01 = 6.85E+02 kg CO_2e (this is 685 kg CO_2e for one Small box culvert 1200 x 1200 x 2.4m, supplied from Pooraka)	2.69E+03 + 9.03E+02 = 3.59E+03 kg CO_2e (this is 3,590 kg CO_2e for one 15m long Humes deck, supplied from Townsville)

Sydney (Blacktown), NSW

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Sydney (Blacktown) manufacturing site.

Table 5: Environmental indicators, precast concrete products manufactured in Sydney, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m³)	2,340 kg/m³	2,360 kg/m³	2,360 kg/m³	
Environmental Indicator	**1t Humes Routine Mix (NS501F-891)**	**1t Project Specific Mix (NS501F-895)**	**1t High Early Strength Mix (NS501G-893)**	**1 kg reinforcement steel, Sydney**
GWP [kg CO_2 eq]	2.96E+02	2.75E+02	3.57E+02	1.11E+00
ODP [kg CFC11 eq]	2.69E-06	2.51E-06	2.93E-06	8.64E-08
AP [kg SO_2 eq]	4.93E-01	4.48E-01	6.14E-01	6.18E-03
EP [kg PO_4^{3-} eq]	1.05E-01	9.60E-02	1.30E-01	8.07E-04
POCP [kg C_2H_4 eq]	3.64E-02	3.35E-02	4.25E-02	7.95E-04
ADPE [kg Sb eq]	7.20E-06	5.94E-06	6.28E-06	7.63E-06
ADPF [MJ_{NCV}]	2.76E+03	2.63E+03	3.08E+03	1.78E+01
Resource Use	**1t Humes Routine Mix (NS501F-891)**	**1t Project Specific Mix (NS501F-895)**	**1t High Early Strength Mix (NS501G-893)**	**1 kg reinforcement steel, Sydney**
PERE [MJ_{NCV}]	4.31E+01	4.06E+01	4.66E+01	1.18E+00
PERM [MJ_{NCV}]	1.47E-02	1.62E-06	2.57E-03	0
PERT [MJ_{NCV}]	4.31E+01	4.06E+01	4.66E+01	1.18E+00
PENRE [MJ_{NCV}]	2.78E+03	2.65E+03	3.10E+03	1.73E+01
PENRM [MJ_{NCV}]	7.48E+00	4.72E+00	5.28E+00	0
PENRT [MJ_{NCV}]	2.79E+03	2.65E+03	3.11E+03	1.73E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	0
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	0
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	0
FW [m^3]	1.86E+00	1.88E+00	1.92E+00	9.73E-02
Waste Categories	**1t Humes Routine Mix (NS501F-891)**	**1t Project Specific Mix (NS501F-895)**	**1t High Early Strength Mix (NS501G-893)**	**1 kg reinforcement steel, Sydney**
HW [kg]	1.04E-05	5.37E-06	6.33E-06	0
NHW [kg]	1.04E+00	8.69E-01	9.42E-01	1.32E-05
RW [kg]	1.57E-03	9.34E-04	1.06E-03	0
Output flows	**1t Humes Routine Mix (NS501F-891)**	**1t Project Specific Mix (NS501F-895)**	**1t High Early Strength Mix (NS501G-893)**	**1 kg reinforcement steel, Sydney**
CRU [kg]	0	0	0	0
MFR [kg]	2.20E+01	2.20E+01	2.20E+01	1.07E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	0
EE [MJ]	0	0	0	0

Tamworth, NSW

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Tamworth manufacturing site.

Table 6: Environmental indicators, precast concrete products manufactured in Tamworth, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m^3)	2,380 kg/m^3	2,380 kg/m^3	
Environmental Indicator	**1t Humes Routine Mix (NS504M550)**	**1t Project Specific Mix (NS602F180)**	**1 kg reinforcement steel, Tamworth**
GWP [kg CO_2 eq]	2.15E+02	2.01E+02	1.74E+00
ODP [kg CFC11 eq]	3.74E-06	3.57E-06	2.57E-09
AP [kg SO_2 eq]	5.02E-01	4.69E-01	5.37E-03
EP [kg PO_4^{3-} eq]	1.06E-01	9.89E-02	5.84E-04
POCP [kg C_2H_4 eq]	3.57E-02	3.37E-02	1.01E-03
ADPE [kg Sb eq]	9.15E-06	8.49E-06	4.54E-07
ADPF [MJ_{NCV}]	1.64E+03	1.55E+03	1.94E+01
Resource Use	**1t Humes Routine Mix (NS504M550)**	**1t Project Specific Mix (NS602F180)**	**1 kg reinforcement steel, Tamworth**
PERE [MJ_{NCV}]	3.04E+01	2.89E+01	1.08E+00
PERM [MJ_{NCV}]	7.19E-03	0.00E+00	0
PERT [MJ_{NCV}]	3.04E+01	2.89E+01	1.08E+00
PENRE [MJ_{NCV}]	1.67E+03	1.58E+03	1.95E+01
PENRM [MJ_{NCV}]	7.70E+00	6.16E+00	0
PENRT [MJ_{NCV}]	1.68E+03	1.59E+03	1.95E+01
SM [kg]	3.93E-01	3.93E-01	9.76E-01
RSF [MJ_{NCV}]	1.13E-08	1.13E-08	0
NRSF [MJ_{NCV}]	4.60E-05	4.60E-05	6.34E-02
FW [m^3]	1.77E+00	1.79E+00	7.13E-03
Waste Categories	**1t Humes Routine Mix (NS504M550)**	**1t Project Specific Mix (NS602F180)**	**1 kg reinforcement steel, Tamworth**
HW [kg]	9.81E-06	7.16E-06	4.92E-09
NHW [kg]	1.14E+00	1.05E+00	3.77E-01
RW [kg]	1.59E-03	1.24E-03	3.49E-05
Output flows	**1t Humes Routine Mix (NS504M550)**	**1t Project Specific Mix (NS602F180)**	**1 kg reinforcement steel, Tamworth**
CRU [kg]	0	0	0
MFR [kg]	7.70E+00	7.70E+00	1.03E-01
MER [kg]	7.71E-04	7.71E-04	3.03E-04
EE [MJ]	0	0	0

Ipswich, QLD

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Ipswich manufacturing site.

Table 7: Environmental indicators, precast concrete products manufactured in Ipswich, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m^3)	2,400 kg/m^3	2,360 kg/m^3	2,400 kg/m^3	2,400 kg/m^3	
Environmental Indicator	**1t Humes Current Routine Mix (QS502F500)**	**1t Humes Archived Routine Mix (QS502F520)**	**1t Project Specific Mix (QS552T500)**	**1t High Early Strength Mix (QS502FDBL)**	**1 kg reinforcement steel, Ipswich**
GWP [kg CO_2 eq]	2.02E+02	2.04E+02	1.71E+02	2.24E+02	1.98E+00
ODP [kg CFC11 eq]	2.00E-06	1.95E-06	2.15E-06	2.08E-06	7.29E-09
AP [kg SO_2 eq]	4.84E-01	4.88E-01	4.72E-01	5.26E-01	5.87E-03
EP [kg PO_4^{3-} eq]	1.05E-01	1.06E-01	9.57E-02	1.14E-01	6.56E-04
POCP [kg C_2H_4 eq]	2.98E-02	2.98E-02	2.95E-02	3.21E-02	1.26E-03
ADPE [kg Sb eq]	7.42E-06	7.03E-06	7.45E-06	7.36E-06	5.40E-07
ADPF [MJ_{NCV}]	1.62E+03	1.61E+03	1.51E+03	1.73E+03	2.21E+01
Resource Use	**1t Humes Current Routine Mix (QS502F500)**	**1t Humes Archived Routine Mix (QS502F520)**	**1t Project Specific Mix (QS552T500)**	**1t High Early Strength Mix (QS502FDBL)**	**1 kg reinforcement steel, Ipswich**
PERE [MJ_{NCV}]	2.99E+01	2.89E+01	2.89E+01	3.13E+01	1.17E+00
PERM [MJ_{NCV}]	1.30E-02	1.44E-02	9.19E-03	9.21E-03	0
PERT [MJ_{NCV}]	2.99E+01	2.89E+01	2.89E+01	3.13E+01	1.17E+00
PENRE [MJ_{NCV}]	1.63E+03	1.63E+03	1.53E+03	1.75E+03	2.22E+01
PENRM [MJ_{NCV}]	7.96E+00	6.83E+00	9.03E+00	8.44E+00	0
PENRT [MJ_{NCV}]	1.64E+03	1.63E+03	1.54E+03	1.76E+03	2.22E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	2.25E-01	9.49E-01
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	7.24E-09	0
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	6.89E-04	6.14E-02
FW [m^3]	1.59E+00	1.53E+00	1.56E+00	1.56E+00	7.73E-03
Waste Categories	**1t Humes Current Routine Mix (QS502F500)**	**1t Humes Archived Routine Mix (QS502F520)**	**1t Project Specific Mix (QS552T500)**	**1t High Early Strength Mix (QS502FDBL)**	**1 kg reinforcement steel, Ipswich**
HW [kg]	1.06E-05	9.63E-06	1.13E-05	1.06E-05	5.36E-09
NHW [kg]	8.47E-01	8.49E-01	8.04E-01	8.21E-01	4.23E-01
RW [kg]	1.64E-03	1.44E-03	1.81E-03	1.70E-03	3.87E-05
Output flows	**1t Humes Current Routine Mix (QS502F500)**	**1t Humes Archived Routine Mix (QS502F520)**	**1t Project Specific Mix (QS552T500)**	**1t High Early Strength Mix (QS502FDBL)**	**1 kg reinforcement steel, Ipswich**
CRU [kg]	0	0	0	0	0
MFR [kg]	2.44E+01	2.44E+01	2.44E+01	2.44E+01	9.83E-02
MER [kg]	4.14E-04	4.14E-04	4.14E-04	4.14E-04	3.94E-04
EE [MJ]	0	0	0	0	0

Rockhampton, QLD

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Rockhampton manufacturing site.

Table 8: Environmental indicators, precast concrete products manufactured in Rockhampton, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m^3)	2,440 kg/m^3	2,440 kg/m^3	2,420 kg/m^3		
Environmental Indicator	**1t Humes Routine Mix (490-20-SWC)**	**1t Project Specific Mix (520-20-SWC)**	**1t High Early Strength Mix (550-20-SWC)**	**1 kg reinforcement steel, Rockhampton**	**1 kg steel strand, Rockhampton**
GWP [kg CO_2 eq]	2.01E+02	2.09E+02	2.16E+02	1.84E+00	3.22E+00
ODP [kg CFC11 eq]	1.88E-06	1.92E-06	1.95E-06	1.16E-08	1.74E-07
AP [kg SO_2 eq]	3.92E-01	4.09E-01	4.22E-01	5.64E-03	1.32E-02
EP [kg PO_4^{3-} eq]	8.40E-02	8.73E-02	8.99E-02	6.35E-04	2.12E-03
POCP [kg C_2H_4 eq]	2.71E-02	2.80E-02	2.87E-02	1.09E-03	3.93E-03
ADPE [kg Sb eq]	6.97E-06	6.97E-06	6.97E-06	8.38E-07	9.99E-05
ADPF [MJ_{NCV}]	1.66E+03	1.71E+03	1.74E+03	2.06E+01	4.52E+01
Resource Use	**1t Humes Routine Mix (490-20-SWC)**	**1t Project Specific Mix (520-20-SWC)**	**1t High Early Strength Mix (550-20-SWC)**	**1 kg reinforcement steel, Rockhampton**	**1 kg steel strand, Rockhampton**
PERE [MJ_{NCV}]	2.73E+01	2.79E+01	2.83E+01	1.10E+00	2.92E+00
PERM [MJ_{NCV}]	1.12E-02	1.11E-02	1.11E-02	0	0.00E+00
PERT [MJ_{NCV}]	2.73E+01	2.79E+01	2.83E+01	1.10E+00	2.92E+00
PENRE [MJ_{NCV}]	1.68E+03	1.72E+03	1.76E+03	2.09E+01	3.63E+01
PENRM [MJ_{NCV}]	7.86E+00	7.80E+00	7.75E+00	2.74E-06	0.00E+00
PENRT [MJ_{NCV}]	1.69E+03	1.73E+03	1.77E+03	2.09E+01	3.63E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	9.62E-01	0.00E+00
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	8.64E-10	0.00E+00
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	6.22E-02	0.00E+00
FW [m^3]	1.86E+00	1.85E+00	1.84E+00	1.17E-02	1.69E-01
Waste Categories	**1t Humes Routine Mix (490-20-SWC)**	**1t Project Specific Mix (520-20-SWC)**	**1t High Early Strength Mix (550-20-SWC)**	**1 kg reinforcement steel, Rockhampton**	**1 kg steel strand, Rockhampton**
HW [kg]	1.03E-05	1.02E-05	1.02E-05	9.26E-09	0
NHW [kg]	7.88E-01	7.92E-01	7.94E-01	3.81E-01	1.27E-05
RW [kg]	1.61E-03	1.60E-03	1.59E-03	3.66E-05	0
Output flows	**1t Humes Routine Mix (490-20-SWC)**	**1t Project Specific Mix (520-20-SWC)**	**1t High Early Strength Mix (550-20-SWC)**	**1 kg reinforcement steel, Rockhampton**	**1 kg steel strand, Rockhampton**
CRU [kg]	0	0	0	0	0
MFR [kg]	4.30E+00	4.30E+00	4.30E+00	1.01E-01	1.00E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	3.17E-04	0
EE [MJ]	0	0	0	0	0

Townsville, QLD

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Townsville manufacturing site.

Table 9: Environmental indicators, precast concrete products manufactured in Townsville, stages A1-A3, per tonne of concrete and kg of reinforcement steel and steel strand

Mix density (kg/m^3)	2,380 kg/m^3	2,380 kg/m^3	2,380 kg/m^3		
Environmental Indicator	**1t Humes Routine Mix (QS502F520/ QS552F520)**	**1t Project Specific Mix (QS502F490)**	**1t High Early Strength Mix (QS502HUME/ QS552HUME)**	**1 kg reinforcement steel, Townsville**	**1 kg steel strand, Townsville**
GWP [kg CO_2 eq]	2.21E+02	2.12E+02	2.29E+02	1.74E+00	3.19E+00
ODP [kg CFC11 eq]	2.76E-06	2.69E-06	2.82E-06	9.91E-10	1.70E-07
AP [kg SO_2 eq]	4.80E-01	4.59E-01	4.98E-01	5.34E-03	1.43E-02
EP [kg PO_4^{3-} eq]	1.04E-01	9.99E-02	1.08E-01	5.80E-04	2.20E-03
POCP [kg C_2H_4 eq]	3.15E-02	3.06E-02	3.25E-02	1.03E-03	3.95E-03
ADPE [kg Sb eq]	7.08E-06	7.65E-06	7.71E-06	5.06E-07	9.99E-05
ADPF [MJ_{NCV}]	1.84E+03	1.80E+03	1.90E+03	1.94E+01	4.48E+01
Resource Use	**1t Humes Routine Mix (QS502F520/ QS552F520)**	**1t Project Specific Mix (QS502F490)**	**1t High Early Strength Mix (QS502HUME/ QS552HUME)**	**1 kg reinforcement steel, Townsville**	**1 kg steel strand, Townsville**
PERE [MJ_{NCV}]	3.04E+01	3.06E+01	3.17E+01	1.09E+00	2.92E+00
PERM [MJ_{NCV}]	7.16E-03	6.58E-03	1.43E-02	0	0
PERT [MJ_{NCV}]	3.04E+01	3.06E+01	3.17E+01	1.09E+00	2.92E+00
PENRE [MJ_{NCV}]	1.87E+03	1.82E+03	1.92E+03	1.95E+01	3.59E+01
PENRM [MJ_{NCV}]	9.10E+00	1.16E+01	1.03E+01	0	0
PENRT [MJ_{NCV}]	1.88E+03	1.84E+03	1.93E+03	1.95E+01	3.59E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	9.59E-01	0
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	0	0
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	6.23E-02	0
FW [m^3]	1.71E+00	1.73E+00	1.71E+00	7.23E-03	1.69E-01
Waste Categories	**1t Humes Routine Mix (QS502F520/ QS552F520)**	**1t Project Specific Mix (QS502F490)**	**1t High Early Strength Mix (QS502HUME/ QS552HUME)**	**1 kg reinforcement steel, Townsville**	**1 kg steel strand, Townsville**
HW [kg]	1.11E-05	1.37E-05	1.34E-05	4.95E-09	0
NHW [kg]	8.16E-01	8.19E-01	8.99E-01	3.80E-01	9.53E-06
RW [kg]	1.81E-03	2.27E-03	2.09E-03	3.51E-05	0
Output flows	**1t Humes Routine Mix (QS502F520/ QS552F520)**	**1t Project Specific Mix (QS502F490)**	**1t High Early Strength Mix (QS502HUME/ QS552HUME)**	**1 kg reinforcement steel, Townsville**	**1 kg steel strand, Townsville**
CRU [kg]	0	0	0	0	0
MFR [kg]	1.80E+01	1.80E+01	1.80E+01	1.01E-01	1.00E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	3.15E-04	0
EE [MJ]	0	0	0	0	0

Melbourne (Laverton), VIC

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Melbourne (Laverton) manufacturing site.

Table 10: Environmental indicators, precast concrete products manufactured in Melbourne, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m^3)	2,420 kg/m^3	2,400 kg/m^3	2,400 kg/m^3		
Environmental Indicator	**1t Humes Routine Mix (VS502V5HE)**	**1t Project Specific Mix (VS502VR18)**	**1t High Early Strength Mix (VS501FSWC)**	**1 kg reinforcement steel, Melbourne**	**1 kg steel strand, Melbourne**
GWP [kg CO_2 eq]	3.05E+02	2.39E+02	3.26E+02	1.96E+00	3.69E+00
ODP [kg CFC11 eq]	3.34E-06	2.86E-06	3.21E-06	3.72E-09	1.98E-07
AP [kg SO_2 eq]	6.16E-01	4.71E-01	6.46E-01	6.14E-03	1.69E-02
EP [kg PO_4^{3-} eq]	1.32E-01	1.02E-01	1.38E-01	6.75E-04	2.57E-03
POCP [kg C_2H_4 eq]	3.75E-02	3.00E-02	3.92E-02	1.13E-03	4.56E-03
ADPE [kg Sb eq]	8.08E-06	6.65E-06	7.81E-06	2.25E-06	1.15E-04
ADPF [MJ_{NCV}]	2.42E+03	2.02E+03	2.52E+03	2.20E+01	5.18E+01
Resource Use	**1t Humes Routine Mix (VS502V5HE)**	**1t Project Specific Mix (VS502VR18)**	**1t High Early Strength Mix (VS501FSWC)**	**1 kg reinforcement steel, Melbourne**	**1 kg steel strand, Melbourne**
PERE [MJ_{NCV}]	5.34E+01	4.72E+01	5.51E+01	1.25E+00	3.36E+00
PERM [MJ_{NCV}]	1.62E-06	1.62E-06	1.62E-06	0	0
PERT [MJ_{NCV}]	5.34E+01	4.72E+01	5.51E+01	1.25E+00	3.36E+00
PENRE [MJ_{NCV}]	2.44E+03	2.05E+03	2.55E+03	2.21E+01	4.16E+01
PENRM [MJ_{NCV}]	1.24E+01	5.14E+00	1.26E+01	0	0
PENRT [MJ_{NCV}]	2.45E+03	2.05E+03	2.56E+03	2.21E+01	4.16E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	1.09E+00	0
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	0	0
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	7.11E-02	0
FW [m^3]	1.92E+00	1.94E+00	1.94E+00	1.24E-02	1.94E-01
Waste Categories	**1t Humes Routine Mix (VS502V5HE)**	**1t Project Specific Mix (VS502VR18)**	**1t High Early Strength Mix (VS501FSWC)**	**1 kg reinforcement steel, Melbourne**	**1 kg steel strand, Melbourne**
HW [kg]	2.18E-05	6.40E-06	1.38E-05	5.49E-09	0
NHW [kg]	9.71E-01	8.42E-01	7.53E-01	4.20E-01	1.30E-05
RW [kg]	2.21E-03	1.15E-03	2.40E-03	3.89E-05	0
Output flows	**1t Humes Routine Mix (VS502V5HE)**	**1t Project Specific Mix (VS502VR18)**	**1t High Early Strength Mix (VS501FSWC)**	**1 kg reinforcement steel, Melbourne**	**1 kg steel strand, Melbourne**
CRU [kg]	0	0	0	0	0
MFR [kg]	1.00E+02	1.00E+02	1.00E+02	1.19E-01	1.00E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	3.35E-04	0
EE [MJ]	0	0	0	0	0

Echuca, VIC

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Echuca manufacturing site.

Table 11: Environmental indicators, precast concrete products manufactured in Echuca, stages A1-A3, per tonne of concrete and kg of reinforcement steel and steel strand

Mix density (kg/m^3)	2,480 kg/m^3	2,480 kg/m^3	2,480 kg/m^3	2,500 kg/m^3		
Environmental Indicator	**1t Humes Routine Mix (VS504FVPW/ SWC55050FA)**	**1t Project Specific Mix (VS504GVP5/ 460E650)**	**1t Project Specific Mix (VS504FVP5/ 460E650FA)**	**1t High Early Strength Mix (VS504GVPW/ SWC55050)**	**1 kg reinforcement steel, Echuca**	**1 kg steel strand, Echuca**
GWP [kg CO_2 eq]	2.44E+02	2.52E+02	2.13E+02	2.85E+02	1.06E+00	3.26E+00
ODP [kg CFC11 eq]	3.55E-06	2.94E-06	3.18E-06	3.21E-06	8.34E-08	1.75E-07
AP [kg SO_2 eq]	5.09E-01	4.90E-01	4.34E-01	5.64E-01	5.75E-03	1.49E-02
EP [kg PO_4^{3-} eq]	1.09E-01	1.04E-01	9.30E-02	1.19E-01	7.47E-04	2.27E-03
POCP [kg C_2H_4 eq]	3.56E-02	3.45E-02	3.13E-02	3.86E-02	7.59E-04	4.02E-03
ADPE [kg Sb eq]	1.02E-05	7.03E-06	6.64E-06	7.83E-06	3.91E-06	1.01E-04
ADPF [MJ_{NCV}]	2.14E+03	2.12E+03	1.93E+03	2.31E+03	1.72E+01	4.57E+01
Resource Use	**1t Humes Routine Mix (VS504FVPW/ SWC55050FA)**	**1t Project Specific Mix (VS504GVP5/ 460E650)**	**1t Project Specific Mix (VS504FVP5/ 460E650FA)**	**1t High Early Strength Mix (VS504GVPW/ SWC55050)**	**1 kg reinforcement steel, Echuca**	**1 kg steel strand, Echuca**
PERE [MJ_{NCV}]	3.71E+01	3.52E+01	3.17E+01	3.82E+01	1.13E+00	2.96E+00
PERM [MJ_{NCV}]	4.93E-02	1.62E-06	1.62E-06	1.92E-02	0	0
PERT [MJ_{NCV}]	3.71E+01	3.52E+01	3.17E+01	3.82E+01	1.13E+00	2.96E+00
PENRE [MJ_{NCV}]	2.17E+03	2.14E+03	1.95E+03	2.34E+03	1.67E+01	3.68E+01
PENRM [MJ_{NCV}]	1.39E+01	9.82E+00	8.53E+00	1.14E+01	0	0
PENRT [MJ_{NCV}]	2.18E+03	2.15E+03	1.96E+03	2.35E+03	1.67E+01	3.68E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	2.25E-01	0	0
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	7.24E-09	0	0
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	6.89E-04	0	0
FW [m^3]	1.70E+00	1.76E+00	1.72E+00	1.75E+00	9.12E-02	1.71E-01
Waste Categories	**1t Humes Routine Mix (VS504FVPW/ SWC55050FA)**	**1t Project Specific Mix (VS504GVP5/ 460E650)**	**1t Project Specific Mix (VS504FVP5/ 460E650FA)**	**1t High Early Strength Mix (VS504GVPW/ SWC55050)**	**1 kg reinforcement steel, Echuca**	**1 kg steel strand, Echuca**
HW [kg]	2.21E-05	1.08E-05	9.45E-06	2.18E-05	0	0
NHW [kg]	1.15E+00	6.40E-01	6.09E-01	8.54E-01	1.35E-05	1.34E-05
RW [kg]	3.06E-03	1.89E-03	1.65E-03	2.04E-03	0	0
Output flows	**1t Humes Routine Mix (VS504FVPW/ SWC55050FA)**	**1t Project Specific Mix (VS504GVP5/ 460E650)**	**1t Project Specific Mix (VS504FVP5/ 460E650FA)**	**1t High Early Strength Mix (VS504GVPW/ SWC55050)**	**1 kg reinforcement steel, Echuca**	**1 kg steel strand, Echuca**
CRU [kg]	0	0	0	0	0	0
MFR [kg]	4.70E+01	4.70E+01	4.70E+01	4.70E+01	1.04E-01	1.00E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	4.14E-04	0	0
EE [MJ]	0	0	0	0	0	0

Adelaide (Pooraka), SA

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Adelaide (Pooraka) manufacturing site.

Table 12: Environmental indicators, precast concrete products manufactured in Adelaide, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m^3)	2,400 kg/m^3	2,400 kg/m^3	2,400 kg/m^3	
Environmental Indicator	**1t Humes Routine Mix (SS501FSWL)**	**1t Project Specific Mix (SS502FHE5)**	**1t Project Specific (Slag) Mix (SS501EN50)**	**1 kg reinforcement steel, Adelaide**
GWP [kg CO_2 eq]	2.35E+02	2.78E+02	1.95E+02	1.18E+00
ODP [kg CFC11 eq]	3.52E-06	4.00E-06	3.68E-06	8.48E-08
AP [kg SO_2 eq]	4.85E-01	5.84E-01	4.51E-01	6.16E-03
EP [kg PO_4^{3-} eq]	1.03E-01	1.23E-01	8.71E-02	8.17E-04
POCP [kg C_2H_4 eq]	3.59E-02	4.13E-02	3.58E-02	8.04E-04
ADPE [kg Sb eq]	6.81E-06	6.89E-06	6.83E-06	1.23E-05
ADPF [MJ_{NCV}]	2.03E+03	2.29E+03	1.89E+03	1.87E+01
Resource Use	**1t Humes Routine Mix (SS501FSWL)**	**1t Project Specific Mix (SS502FHE5)**	**1t Project Specific (Slag) Mix (SS501EN50)**	**1 kg reinforcement steel, Adelaide**
PERE [MJ_{NCV}]	7.10E+01	7.44E+01	6.96E+01	1.32E+00
PERM [MJ_{NCV}]	1.62E-06	1.62E-06	1.62E-06	0
PERT [MJ_{NCV}]	7.10E+01	7.44E+01	6.96E+01	1.32E+00
PENRE [MJ_{NCV}]	2.06E+03	2.32E+03	1.92E+03	1.82E+01
PENRM [MJ_{NCV}]	9.29E+00	1.18E+01	9.47E+00	5.66E-05
PENRT [MJ_{NCV}]	2.07E+03	2.33E+03	1.93E+03	1.82E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	8.17E-02
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	1.79E-08
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	7.24E-05
FW [m^3]	1.79E+00	1.77E+00	1.73E+00	1.87E-01
Waste Categories	**1t Humes Routine Mix (SS501FSWL)**	**1t Project Specific Mix (SS502FHE5)**	**1t Project Specific (Slag) Mix (SS501EN50)**	**1 kg reinforcement steel, Adelaide**
HW [kg]	1.03E-05	2.17E-05	1.05E-05	8.90E-08
NHW [kg]	6.01E-01	6.31E-01	5.91E-01	7.99E-03
RW [kg]	1.79E-03	1.86E-03	1.82E-03	3.02E-05
Output flows	**1t Humes Routine Mix (SS501FSWL)**	**1t Project Specific Mix (SS502FHE5)**	**1t Project Specific (Slag) Mix (SS501EN50)**	**1 kg reinforcement steel, Adelaide**
CRU [kg]	0	0	0	0
MFR [kg]	4.60E+01	4.60E+01	4.60E+01	1.10E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	0
EE [MJ]	0	0	0	0

Perth (Welshpool), WA

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Perth (Welshpool) manufacturing site.

Table 13: Environmental indicators, precast concrete products manufactured in Perth, stages A1-A3, per tonne of concrete and kg of reinforcement steel and steel strand

Mix density (kg/m^3)	2,400 kg/m^3	2,400 kg/m^3	2,520 kg/m^3		
Environmental Indicator	**1t Humes Routine Mix (Precast - TP14)**	**1t Project Specific Mix (WS654TP04)**	**1t Project Specific (Pre-stress) Mix (Prestress - TP04)**	**1 kg reinforcement steel, Perth**	**1 kg steel strand, Perth**
GWP [kg CO_2 eq]	2.51E+02	1.91E+02	2.12E+02	9.88E-01	3.14E+00
ODP [kg CFC11 eq]	4.13E-06	4.06E-06	3.62E-06	7.58E-08	1.66E-07
AP [kg SO_2 eq]	9.59E-01	7.98E-01	8.06E-01	4.85E-03	1.39E-02
EP [kg PO_4^{3-} eq]	1.36E-01	1.09E-01	1.16E-01	6.52E-04	2.15E-03
POCP [kg C_2H_4 eq]	5.27E-02	4.86E-02	4.49E-02	6.93E-04	3.89E-03
ADPE [kg Sb eq]	1.82E-05	2.94E-05	1.35E-05	2.53E-06	9.89E-05
ADPF [MJ_{NCV}]	1.78E+03	1.59E+03	1.53E+03	1.61E+01	4.41E+01
Resource Use	**1t Humes Routine Mix (Precast - TP14)**	**1t Project Specific Mix (WS654TP04)**	**1t Project Specific (Pre-stress) Mix (Prestress - TP04)**	**1 kg reinforcement steel, Perth**	**1 kg steel strand, Perth**
PERE [MJ_{NCV}]	2.87E+01	4.54E+01	2.44E+01	1.09E+00	2.89E+00
PERM [MJ_{NCV}]	3.97E-02	0	0	0	0
PERT [MJ_{NCV}]	2.88E+01	4.54E+01	2.44E+01	1.09E+00	2.89E+00
PENRE [MJ_{NCV}]	1.81E+03	1.61E+03	1.56E+03	1.56E+01	3.53E+01
PENRM [MJ_{NCV}]	6.98E+00	1.01E+01	2.91E+00	0	0
PENRT [MJ_{NCV}]	1.82E+03	1.62E+03	1.56E+03	1.56E+01	3.53E+01
SM [kg]	7.88E-02	7.88E-02	7.88E-02	0	0
RSF [MJ_{NCV}]	4.05E-09	4.05E-09	4.05E-09	0	0
NRSF [MJ_{NCV}]	1.64E-05	1.64E-05	1.64E-05	0	0
FW [m^3]	1.93E+00	2.12E+00	1.86E+00	8.72E-02	1.67E-01
Waste Categories	**1t Humes Routine Mix (Precast - TP14)**	**1t Project Specific Mix (WS654TP04)**	**1t Project Specific (Pre-stress) Mix (Prestress - TP04)**	**1 kg reinforcement steel, Perth**	**1 kg steel strand, Perth**
HW [kg]	1.31E-05	1.94E-05	3.23E-06	0	0
NHW [kg]	6.68E-01	6.56E-01	2.42E-01	7.22E-06	7.15E-06
RW [kg]	1.64E-03	1.86E-03	5.63E-04	0	0
Output flows	**1t Humes Routine Mix (Precast - TP14)**	**1t Project Specific Mix (WS654TP04)**	**1t Project Specific (Pre-stress) Mix (Prestress - TP04)**	**1 kg reinforcement steel, Perth**	**1 kg steel strand, Perth**
CRU [kg]	0	0	0	0	0
MFR [kg]	2.50E+01	2.50E+01	2.50E+01	1.01E-01	1.00E-01
MER [kg]	1.36E-04	1.36E-04	1.36E-04	0	0
EE [MJ]	0	0	0	0	0

Darwin (Winnellie), NT

The following results show the cradle-to-gate environmental indicators of concrete mix designs and reinforcement steel used at the Humes Darwin (Winnellie) manufacturing site.

Table 14: Environmental indicators, precast concrete products manufactured in Darwin, stages A1-A3, per tonne of concrete and kg of reinforcement steel

Mix density (kg/m^3)	2,400 kg/m^3	2,400 kg/m^3	2,400 kg/m^3	
Environmental Indicator	**1t Humes Routine Mix (HBSCS50HI)**	**1t Project Specific Mix (HBS50SCC10)**	**1t Project Specific (Low-heat) Mix (SC S50SCC10 (LH))**	**1 kg reinforcement steel, Darwin**
GWP [kg CO_2 eq]	2.69E+02	2.49E+02	1.75E+02	1.35E+00
ODP [kg CFC11 eq]	5.55E-06	4.84E-06	4.21E-06	1.00E-07
AP [kg SO_2 eq]	1.01E+00	9.18E-01	7.01E-01	6.04E-03
EP [kg PO_4^{3-} eq]	1.50E-01	1.37E-01	1.03E-01	9.63E-04
POCP [kg C_2H_4 eq]	6.60E-02	5.80E-02	4.74E-02	9.21E-04
ADPE [kg Sb eq]	4.05E-05	2.42E-05	1.43E-05	3.02E-05
ADPF [MJ_{NCV}]	2.19E+03	1.99E+03	1.64E+03	2.12E+01
Resource Use	**1t Humes Routine Mix (HBSCS50HI)**	**1t Project Specific Mix (HBS50SCC10)**	**1t Project Specific (Low-heat) Mix (SC S50SCC10 (LH))**	**1 kg reinforcement steel, Darwin**
PERE [MJ_{NCV}]	6.28E+01	4.37E+01	3.54E+01	1.47E+00
PERM [MJ_{NCV}]	1.62E-06	1.62E-06	1.62E-06	0
PERT [MJ_{NCV}]	6.28E+01	4.37E+01	3.54E+01	1.47E+00
PENRE [MJ_{NCV}]	2.21E+03	2.03E+03	1.68E+03	2.03E+01
PENRM [MJ_{NCV}]	1.24E+01	1.24E+01	1.15E+01	0
PENRT [MJ_{NCV}]	2.22E+03	2.04E+03	1.69E+03	2.03E+01
SM [kg]	2.25E-01	2.25E-01	2.25E-01	0
RSF [MJ_{NCV}]	7.24E-09	7.24E-09	7.24E-09	0
NRSF [MJ_{NCV}]	6.89E-04	6.89E-04	6.89E-04	0
FW [m^3]	6.52E+00	6.12E+00	5.78E+00	1.33E-01
Waste Categories	**1t Humes Routine Mix (HBSCS50HI)**	**1t Project Specific Mix (HBS50SCC10)**	**1t Project Specific (Low-heat) Mix (SC S50SCC10 (LH))**	**1 kg reinforcement steel, Darwin**
HW [kg]	1.48E-05	1.45E-05	1.36E-05	0
NHW [kg]	9.42E-01	8.65E-01	8.67E-01	6.13E-06
RW [kg]	2.64E-03	2.59E-03	2.42E-03	0
Output flows	**1t Humes Routine Mix (HBSCS50HI)**	**1t Project Specific Mix (HBS50SCC10)**	**1t Project Specific (Low-heat) Mix (SC S50SCC10 (LH))**	**1 kg reinforcement steel, Darwin**
CRU [kg]	0	0	0	0
MFR [kg]	4.54E+01	4.54E+01	4.54E+01	1.23E-01
MER [kg]	4.14E-04	4.14E-04	4.14E-04	0
EE [MJ]	0	0	0	0

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.

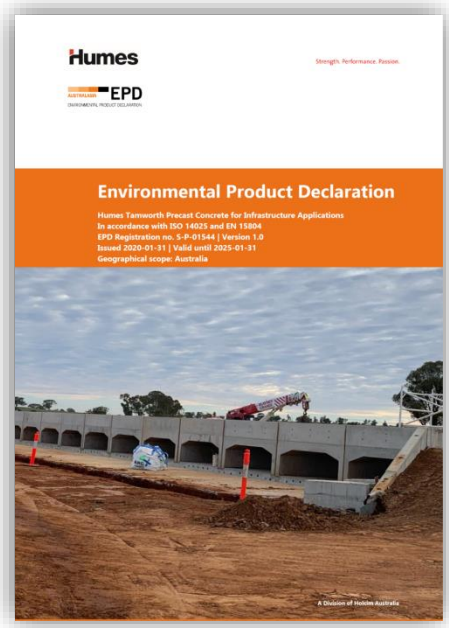
Infrastructure Sustainability

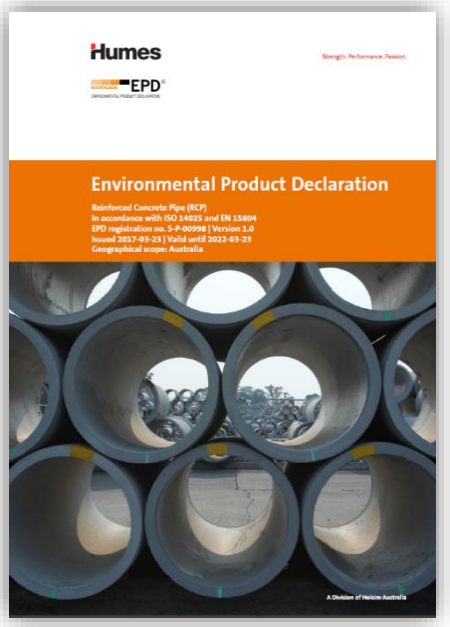
The Infrastructure Sustainability Council of Australia (ISCA) is the peak industry body for advancing sustainability in Australia's infrastructure. As a division of Holcim Australia, Humes is a member of ISCA and takes an interest and role in developing sustainable practises across design, construction 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 third Environmental Product Declaration. Earlier this year we developed an ISO 14025 and EN 15804 compliant EPD for Humes Tamworth precast concrete for infrastructure applications and in 2016 we developed an ISO 14025 and EN 15804 compliant EPD for our reinforced concrete pipe products. These EPDs are publicly available on the EPD Australasia website:





Product Specifications

The following tables are provided so the potential environmental impact can be calculated for a specific concrete volume and steel content weight. The values in the tables represents the product's steel mass and concrete volume that can be converted to a weight in tonnes with the associated sites concrete density so that the results of the LCA can be converted to product units. Please note that these product weights cover a mixture of standard products and examples of elements that typically have unique specified designs. Concrete volumes and steel weights for non-standard products can usually be found in Issued For Manufacturer (IFM) drawings, and can also be used for determining LCA results using this EPD document.

See example calculation on page 13.

Table 15: Example product groups for which specifications are provided in this EPD

Product group	Description
Prestressed piles, decks and girders	Humes manufacture a wide range of prestressed bridge componentry to meet road and rail authority specifications, including beams, decks and planks, I-beams, girders, and piles (rectangular precast concrete section and hexagonal prestressed units).
Headwalls	Humes manufacture a range of standard headwalls to conform to the requirements of individual state and local authorities. Humes also manufacture multiple cell headwalls (for both pipes and box culverts), sloping headwalls and end walls, small box culvert headwalls, and compact headwalls. Where a project requires specific needs, we will work with you to develop a cost-effective headwall design to meet the needs of your project.
Box Culverts	Humes manufacture a full range of box culvert and uni-culvert sizes (from 300mm to 6,600mm) and configurations to Australian Standards AS1597 (parts one and two). Box culverts are generally available in standard lengths of 1.22m and 2.46m (or 1.2m and 2.4m QLD). In many cases Humes has the facility to manufacture larger span and leg heights beyond those indicated in the Australian Standards. Humes also manufacture custom designs such as splayed box culverts, post-tensioning stressing etc.
StormTrap®	The StormTrap® system is an underground trafficable stormwater detention and infiltration solution that provides a high level of value for customers and projects in meeting regulatory requirements, whilst minimising the impact on land usability.
HumeDeck®	HumeDeck® bridge system is a modular precast solution for small to medium sized bridges spanning up to 12 m.

Custom Pits	Humes manufacture a wide range of custom and modular concrete stormwater pits; our range includes lids, grates and covers, base units and risers, and a variety of street furniture to suit different applications and local requirements. Our ability to customise components to suit each project provides design flexibility and economy for installers.
Sleepers	Humes has over 50 years' experience in the provision of prestressed and precast concrete railway sleepers for heavy haulage, mainline, secondary and high-speed tracks across Australia. We provide a range of standard, dual and narrow-gauge sleepers for applications including grain, electrical, transponder, pedestrian, transition and DED sleepers.
Storage Wall Units	Humes manufacture two modular cantilever storage wall systems (the L wall and the T wall) for internal or external retainment, separation, or confinement of bulk materials of all kinds.
Arches	Arches cover a broad range of spans and heights to accommodate a wide range of applications including bridges, tunnels and drainage culverts.

Railway sleepers

Decks

The following table shows examples of prestressed deck units based on Queensland Transport and Main Roads standard drawings.

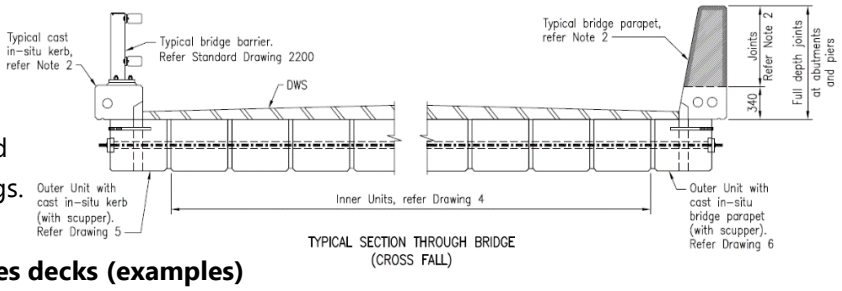


Table 16: Product specifications for Humes decks (examples)

	No voids	With polystyrene voids				
Length (m)	**Depth 500 mm**	**Depth 540 mm**	**Depth 650 mm**	**Depth 760 mm**	**Depth 1100 mm**	
10 m	185					Steel reo mass (kg)
	141					Steel strand mass (kg)
	2.98					Concrete volume (m^3)
11 m	220					Steel reo mass (kg)
	155					Steel strand mass (kg)
	3.28					Concrete volume (m^3)
12 m	244					Steel reo mass (kg)
	188					Steel strand mass (kg)
	3.56					Concrete volume (m^3)
13 m	252	255				Steel reo mass (kg)
	203	203				Steel strand mass (kg)
	4.18	3.55				Concrete volume (m^3)
15 m			324			Steel reo mass (kg)
			283			Steel strand mass (kg)
			5.11			Concrete volume (m^3)
19 m				380		Steel reo mass (kg)
				428		Steel strand mass (kg)
				7.14		Concrete volume (m^3)
25 m					735	Steel reo mass (kg)
					730	Steel strand mass (kg)
					11.96	Concrete volume (m^3)

Prestressed Super T girders

The following table shows examples of prestressed Super T Girder units based on Cooroy to Curra (C2C) drawings.

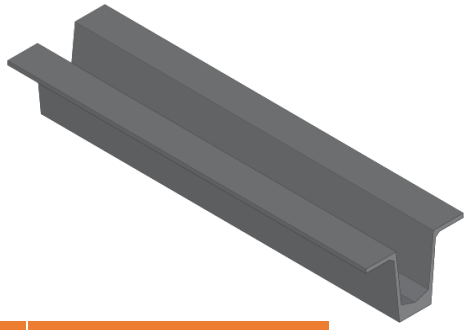


Table 17: Product specifications for Humes Super T girders (examples)

	Depth			
Length (m)	**1825 mm**	**1525 mm (completed stages)**	**1225 mm**	
32.9 (33.0,32.55)	5688	4740		Steel reo mass (kg)
	2295	2002		Steel strand mass (kg)
	29.78	27.12		Concrete volume (m^3)
28.45	4064	3586		Steel reo mass (kg)
	1824	1321		Steel strand mass (kg)
	28.29	22.87		Concrete volume (m^3)
23.65		3140	2940	Steel reo mass (kg)
		1383	1170	Steel strand mass (kg)
		19.19	18.24	Concrete volume (m^3)
20.95			3002	Steel reo mass (kg)
			846	Steel strand mass (kg)
			16.20	Concrete volume (m^3)
18.85			2842	Steel reo mass (kg)
			678	Steel strand mass (kg)
			15.38	Concrete volume (m^3)
17.45			2631	Steel reo mass (kg)
			550	Steel strand mass (kg)
			14.07	Concrete volume (m^3)
14.95			2314	Steel reo mass (kg)
			404	Steel strand mass (kg)
			12.20	Concrete volume (m^3)

Headwalls

The following table shows examples of standard B2 exposure classification headwalls.

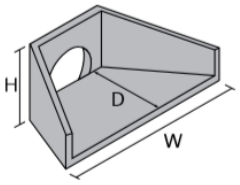


Table 18: Product specifications for Humes headwalls (examples)

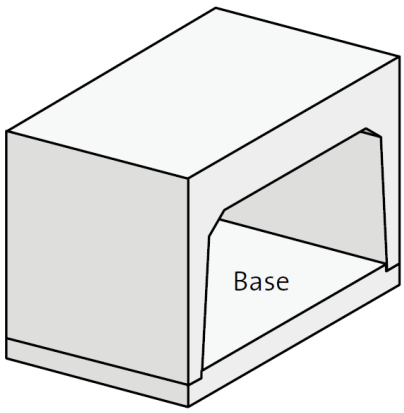
	B2 Headwall Types					
Pipe diameter (mm)	**Sloping Headwall**	**Single Cell**	**Twin Cell 300 gap**	**Twin Cell 600 gap**	**Triple Cell**	
300	2	12				Steel mass (kg)
	0.30	0.16				Concrete volume (m^3)
375	3	11				Steel mass (kg)
	0.30	0.15				Concrete volume (m^3)
450	2	11				Steel mass (kg)
	0.25	0.15				Concrete volume (m^3)
525	11	37				Steel mass (kg)
	0.45	0.39				Concrete volume (m^3)
600	11	35				Steel mass (kg)
	0.35	0.38				Concrete volume (m^3)
675		35			129	Steel mass (kg)
		0.37			1.29	Concrete volume (m^3)
750		33	96	71	125	Steel mass (kg)
		0.43	1.03	1.03	1.24	Concrete volume (m^3)
825		33	95	71	121	Steel mass (kg)
		0.42	1.00	1.00	1.15	Concrete volume (m^3)
900		43	88	65	130	Steel mass (kg)
		0.58	0.97	0.97	1.30	Concrete volume (m^3)
1050		80	131	75	176	Steel mass (kg)
		0.92	1.43	1.25	1.91	Concrete volume (m^3)
1200		84	122	104	165	Steel mass (kg)
		0.98	1.41	1.60	1.88	Concrete volume (m^3)
1350		103				Steel mass (kg)
		1.20				Concrete volume (m^3)
1500		154				Steel mass (kg)
		1.30				Concrete volume (m^3)

Box culverts

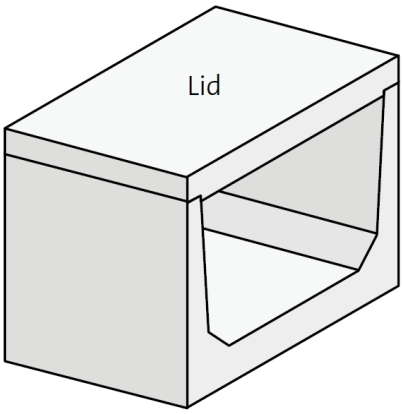
The following table shows standard dimensions for small box culverts. Large box culverts (1500 mm or larger height or span) vary in design from site to site. Please contact your local Humes site for product specifications for large box culverts.

Table 19: Product specifications for Humes box culverts

	Span (mm)						
Height (m)	**300**	**450**	**600**	**750**	**900**	**1200**	
300	17	18	21	36	42	59	Steel mass (kg)
	0.21	0.35	0.40	0.50	0.55	0.64	Concrete volume (m^3)
450		21	25	39	46	63	Steel mass (kg)
		0.40	0.45	0.55	0.65	0.71	Concrete volume (m^3)
600			29	43	49	66	Steel mass (kg)
			0.50	0.60	0.70	0.78	Concrete volume (m^3)
750				46	53	70	Steel mass (kg)
				0.70	0.75	0.85	Concrete volume (m^3)
900					56	72	Steel mass (kg)
					0.85	0.91	Concrete volume (m^3)
1200						79	Steel mass (kg)
						1.05	Concrete volume (m^3)



Crown unit



Invert unit

StormTrap®

The following tables shows standard dimensions for single trap (Table 20) and double trap (Table 21) StormTrap®.

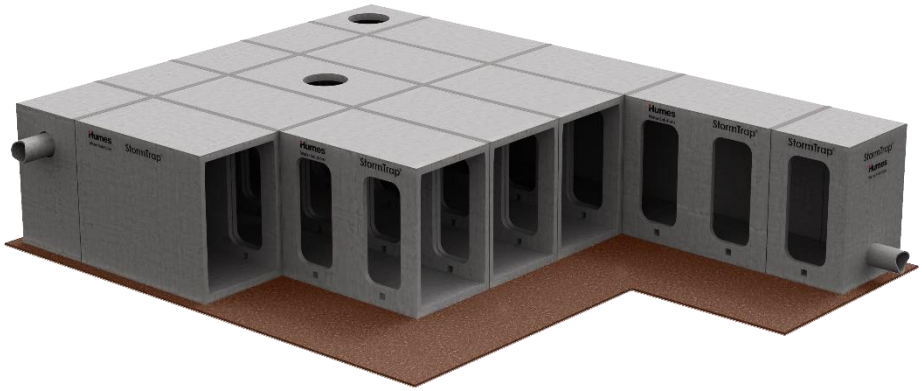
Table 20: Product specifications for Humes single trap StormTrap®

Single trap	StormTrap® type						
Leg height (mm)	I	II	III	IV & V	VI	VII	
600	309	164	306	162	253	146	Steel mass (kg)
	2.10	1.20	2.20	1.24	2.30	1.24	Concrete volume (m^3)
900	404	218	405	217	338	196	Steel mass (kg)
	2.25	1.34	2.40	1.42	2.55	1.50	Concrete volume (m^3)
1200	432	233	438	236	397	215	Steel mass (kg)
	2.35	1.49	2.60	1.60	2.85	1.73	Concrete volume (m^3)
1500	453	247	464	252	423	232	Steel mass (kg)
	2.50	1.63	2.85	1.79	3.15	1.95	Concrete volume (m^3)

StormTrap® (continued)

Table 21: Product specifications for Humes double trap StormTrap®

Double trap	StormTrap® type						
Leg height (mm)	I	II	III	IV & V	VI	VII	
1200	618	328	612	324	324	506	Steel mass (kg)
	4.20	2.40	4.40	2.48	2.48	4.60	Concrete volume (m^3)
1500	796	420	794	418	418	660	Steel mass (kg)
	4.30	2.52	4.60	2.66	2.66	4.80	Concrete volume (m^3)
1800	808	436	810	434	434	676	Steel mass (kg)
	4.50	2.68	4.80	2.84	2.84	5.10	Concrete volume (m^3)
2100	842	450	844	450	450	706	Steel mass (kg)
	4.60	2.82	5.00	3.02	3.02	5.40	Concrete volume (m^3)
2400	864	466	876	472	472	794	Steel mass (kg)
	4.70	2.98	5.20	3.20	3.20	5.70	Concrete volume (m^3)
2700	876	476	894	484	484	810	Steel mass (kg)
	4.90	3.12	5.40	3.40	3.40	6.00	Concrete volume (m^3)
3000	906	494	928	504	504	846	Steel mass (kg)
	5.00	3.26	5.70	3.58	3.58	6.30	Concrete volume (m^3)



HumeDeck®

The following table shows standard dimensions for HumeDeck®.

Table 22: Product specifications for HumeDeck®

	Span (m)					
Width (mm)	**8**	**9**	**10**	**11**	**12**	
2400	1220	1397	1567	1730	2041	Steel mass (kg)
	4.60	5.75	6.75	8.05	9.20	Concrete volume (m^3)
2700	1387	1586	1813	2021	2420	Steel mass (kg)
	5.65	6.85	8.00	9.40	10.70	Concrete volume (m^3)

Figure 2 – Typical deck and girder unit cross-section

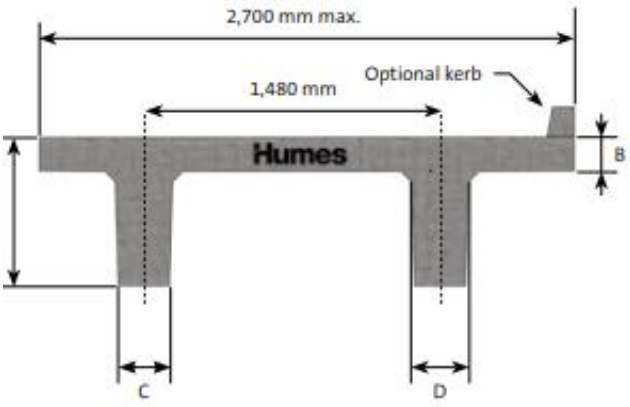
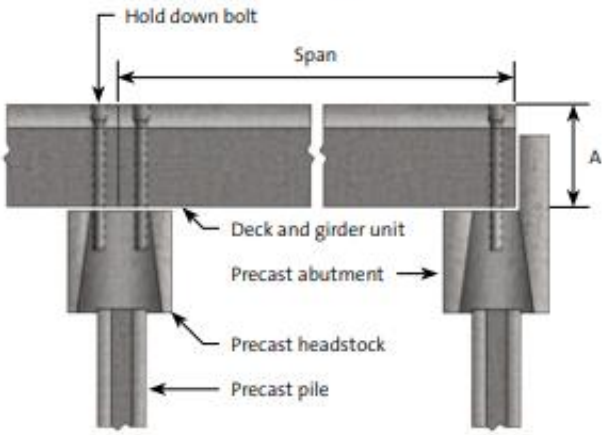
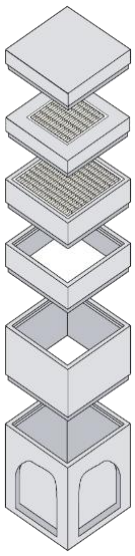


Figure 3 – Cross-section detail of a complete HumeDeck® bridge system





Custom pits

The following tables show standard dimensions for custom pits up to 1300mm height (Table 23) and from 1450mm height (Table 24). For other dimensions, contact your local Humes location.

Table 23: Product specifications for Humes custom pits (700mm to 1300 mm height)

	Depth [Height] (mm)					
Width (mm) / Breadth (mm)	**700**	**850**	**1000**	**1150**	**1300**	
700 / 700	33	35	37	39	41	Steel mass (kg)
	0.31	0.35	0.40	0.45	0.50	Concrete volume (m^3)
850 / 675	35	38	40	42	44	Steel mass (kg)
	0.33	0.39	0.44	0.49	0.54	Concrete volume (m^3)
1380 / 700	54	59	64	69	73	Steel mass (kg)
	0.46	0.53	0.60	0.67	0.74	Concrete volume (m^3)
1540 / 700	58	63	69	78	79	Steel mass (kg)
	0.50	0.57	0.65	0.72	0.79	Concrete volume (m^3)
930 / 610	36	38	40	42	45	Steel mass (kg)
	0.34	0.39	0.44	0.49	0.54	Concrete volume (m^3)
930 / 710	39	41	43	45	48	Steel mass (kg)
	0.36	0.42	0.47	0.52	0.58	Concrete volume (m^3)
930 / 835	43	45	48	50	52	Steel mass (kg)
	0.39	0.45	0.51	0.57	0.63	Concrete volume (m^3)
900 / 900	44	46	49	51	53	Steel mass (kg)
	0.40	0.46	0.52	0.58	0.64	Concrete volume (m^3)
1050 / 1050	53	56	59	62	64	Steel mass (kg)
	0.48	0.55	0.62	0.69	0.75	Concrete volume (m^3)
1200 / 1200	64	67	70	73	76	Steel mass (kg)
	0.56	0.64	0.72	0.79	0.87	Concrete volume (m^3)

Custom pits (continued)

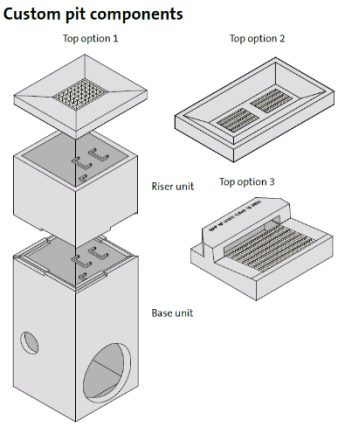


Table 24: Product specifications for Humes custom pits (1450mm to 2000mm height)

	Depth [Height] (mm)					
Width (mm) / Breadth (mm)	**1450**	**1600**	**1750**	**1900**	**2000**	
700 / 700	43	45	47	49	50	Steel mass (kg)
	0.55	0.59	0.64	0.69	0.72	Concrete volume (m^3)
850 / 675	46	48	50	52	54	Steel mass (kg)
	0.59	0.64	0.70	0.75	0.78	Concrete volume (m^3)
1380 / 700	78	83	88	93	96	Steel mass (kg)
	0.80	0.87	0.94	1.01	1.05	Concrete volume (m^3)
1540 / 700	84	90	95	100	104	Steel mass (kg)
	0.86	0.94	1.01	1.08	1.13	Concrete volume (m^3)
930 / 610	47	49	51	53	55	Steel mass (kg)
	0.60	0.65	0.70	0.75	0.79	Concrete volume (m^3)
930 / 710	50	52	54	57	58	Steel mass (kg)
	0.64	0.69	0.75	0.80	0.84	Concrete volume (m^3)
930 / 835	54	57	59	62	63	Steel mass (kg)
	0.69	0.75	0.81	0.86	0.90	Concrete volume (m^3)
900 / 900	56	58	61	63	65	Steel mass (kg)
	0.70	0.76	0.82	0.88	0.92	Concrete volume (m^3)
1050 / 1050	67	70	73	75	77	Steel mass (kg)
	0.82	0.89	0.96	1.03	1.08	Concrete volume (m^3)
1200 / 1200	79	83	86	89	91	Steel mass (kg)
	0.95	1.03	1.11	1.18	1.24	Concrete volume (m^3)

Sleepers

The following table shows examples of our standard profile sleepers.

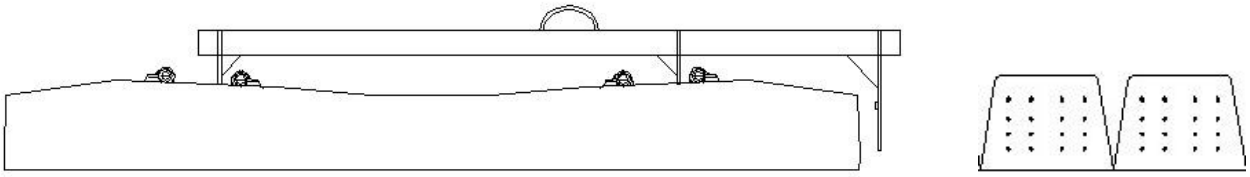
Table 25: Product specifications for Humes sleepers (examples)

	Profile			
Gauge	**Low profile**	**Full depth**	**Full Depth - Heavy Haul (42TAL)**	
Narrow gauge	6.09	7.15		Steel strand mass (kg)*
	0.064	0.106		Concrete volume (m^3)
Standard gauge	7.18	8.37	10.07	Steel strand mass (kg)*
	0.072	0.140	0.134	Concrete volume (m^3)
Dual gauge		8.832		Steel strand mass (kg)*
		0.150		Concrete volume (m^3)

** The steel mass includes reinforcement steel only. Every sleeper also contains cast-in iron shoulders (that are used to attach the rails to the sleepers). The iron shoulders weigh 4.840 kg each and should be added to the environmental profile of the sleepers. We have included an indicative environmental profile for cast-in iron shoulders (see Table 26), based on ecoinvent v3 data, 10% milling losses and transport to Perth.*

Table 26: Indicative environmental profile for cast-in shoulders, total per sleeper

Environmental Indicator	Cast iron shoulders (4x) for Standard gauge and Narrow gauge sleepers	Cast iron shoulders (6x) for Dual gauge sleepers
GWP [kg CO_2 eq]	4.06E+01	6.09E+01
ODP [kg CFC11 eq]	2.20E-06	3.30E-06
AP [kg SO_2 eq]	1.65E-01	2.47E-01
EP [kg PO_4^{3-} eq]	2.48E-02	3.72E-02
POCP [kg C_2H_4 eq]	4.81E-02	7.21E-02
ADPE [kg Sb eq]	3.87E-05	5.80E-05
ADPF [MJ_{NCV}]	6.07E+02	9.10E+02

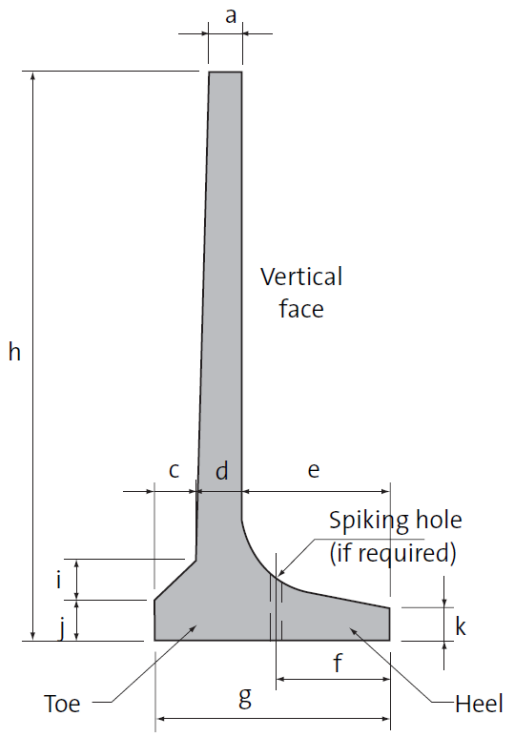


Standard L walls

The following table shows standard dimensions for standard L walls.

Table 27: Product specifications for Humes standard L walls

	Height (mm)							
Length (mm)	**1.07**	**1.52**	**2.44**	**3.66**	**4.57**	**5.49**	**6.1**	
610	6	22	39	86	143	200	252	Steel mass (kg)
	0.10	0.20	0.30	0.70	1.05	1.50	1.55	Concrete volume (m^3)
1200	10	34	65	144	225	312	457	Steel mass (kg)
	0.15	0.30	0.60	1.40	2.00	2.95	3.05	Concrete volume (m^3)

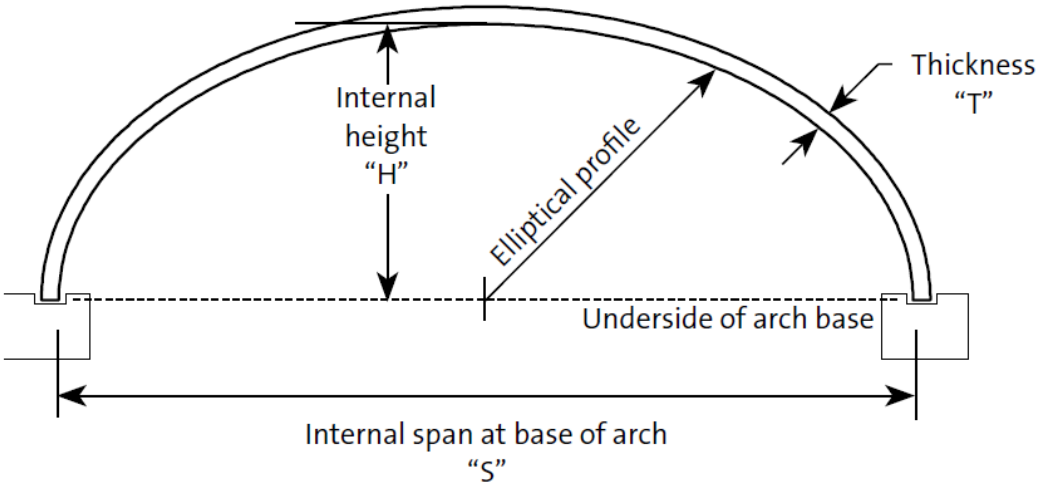


Arches

The following table shows standard dimensions for arches.

Table 28: Product specifications for Humes arches

	Internal span (m)						
Internal height (m)	6	9	12	15	18	21	
2.1	419						Steel mass (kg)
	4.15						Concrete volume (m^3)
3.1	503						Steel mass (kg)
	5.15						Concrete volume (m^3)
3		472	670				Steel mass (kg)
		5.50	6.50				Concrete volume (m^3)
4		544	728				Steel mass (kg)
		6.40	7.30				Concrete volume (m^3)
5				1272			Steel mass (kg)
				11.90			Concrete volume (m^3)
6					1510		Steel mass (kg)
					14.45		Concrete volume (m^3)
7						2926	Steel mass (kg)
						17.00	Concrete volume (m^3)



References

CEN 2013 — EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products, European Committee for Standardization (CEN), Brussels, November 2013

EFCA 2015a — EPD of Plasticizer and superplasticizer, IBU EPD Declaration number EPD-EFC-20150091-IAG1-EN, issued 2015-09-14, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations

EFCA 2015b — EPD of Set accelerators, IBU EPD Declaration number EPD-EFC-20150087-IAG1-EN, issued 2015-09-14, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations

EFCA 2015c — EPD of Hardening accelerators, IBU EPD Declaration number EPD-EFC-20150089-IAG1-EN, issued 2015-09-14, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations

EFCA 2015d — EPD of Air entrainers, IBU EPD Declaration number EPD-EFC-20150086-IAG1-EN, issued 2015-09-14, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations

EFCA 2015e — EPD of Retarders, IBU EPD Declaration number EPD-EFC-20150088-IAG1-EN, issued 2015-09-14, based on EN 15804 and PCR for concrete admixtures; EPD owner: EFCA - European Federation of Concrete Admixtures Associations

Environdec 2020a — PCR2012:01 (version 2.33), Product category rules according to ISO 14025 and EN 15804, Combined PCR and PCR Basic Module for Construction products and Construction services, registration number 2012:01, published on 18 September 2020

Environdec 2020b — PCR2012:01-SUB-PCR-G (version 2.31), Product category rules according to ISO 14025 and EN 15804, Concrete and concrete elements (EN 16757:2017), registration number 2012:01, published on 18 September 2020

Humes 2017 — EPD of Reinforced Concrete Pipe (RCP), EPD Australasia registration no. S-P-00998 | Version 1.0, issued 2017-03-17, based on EN 15804 and PCR for Construction Products and Construction Services; EPD owner: Holcim (Australia) Pty Ltd

Humes 2020 — EPD of Humes Tamworth Precast Concrete for Infrastructure Applications, EPD Australasia registration no. S-P-01544 | Version 1.0, issued 2020-01-31, based on EN 15804 and PCR for Construction Products and Construction Services; EPD owner: Holcim (Australia) Pty Ltd

ISO 2006a — ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework. International Organization for Standardization, Geneva, Switzerland, 2006

ISO 2006b — ISO14044:2006, Environmental management - Life cycle assessment - Requirements and guidelines. International Organization for Standardization, Geneva, Switzerland, 2006

ISO 2006c — ISO14025:2006, Environmental labels and declarations - Type III environmental declarations - Principles and procedures. International Organization for Standardization, Geneva, Switzerland, 2006

NOHSC 2004 — Approved criteria for classifying hazardous substances [NOHSC: 1008(2004)], 3rd Edition, National Occupational Health and Safety Commission, Canberra, October 2004

InfraBuild 2020a — EPD of Reinforcing bar and mesh, EPD Australasia Declaration number S-P-00857 version 1.1, issued 2020-09-21, based on EN 15804 and PCR 2012:01 Construction products and Construction services, Version 2.31, 2019-12-20; EPD owner: InfraBuild Construction Solutions

InfraBuild 2020b — EPD of Reinforcing bar and mesh, EPD Australasia Declaration number S-P-00858 version 1.1, issued 2020-09-21, based on EN 15804 and PCR 2012:01 Construction products and Construction services, Version 2.31, 2019-12-20; EPD owner: ARC - The Australian Reinforcing Company

InfraBuild 2020c — EPD of Reinforcing Rod, Bar and Wire, EPD Australasia Declaration number S-P-00855 version 1.1, issued 2020- 09-21, based on EN 15804 and PCR 2012:01 Construction products and Construction services, Version 2.31, 2019-12-20; EPD owner: InfraBuild Australia Pty Ltd

SA 2000 — AS 1478.1:2000 Chemical admixtures for concrete, mortar and grout, Part 1: Admixtures for concrete, published on 4 October 2000 by Standards Australia, Sydney

SA 2007 — 4672.1:2007 Steel prestressing materials General requirements, published on 18 January 2007 by Standards Australia, Sydney

SA 2010 — AS 3972:2010 General Purpose and blended cements, published on 22 October 2010 by Standards Australia, Sydney

SA 2014 — AS 2758.1:2014 Aggregates and rock for engineering purposes Part 1: Concrete aggregates, published on 7 November 2014 by Standards Australia, Sydney

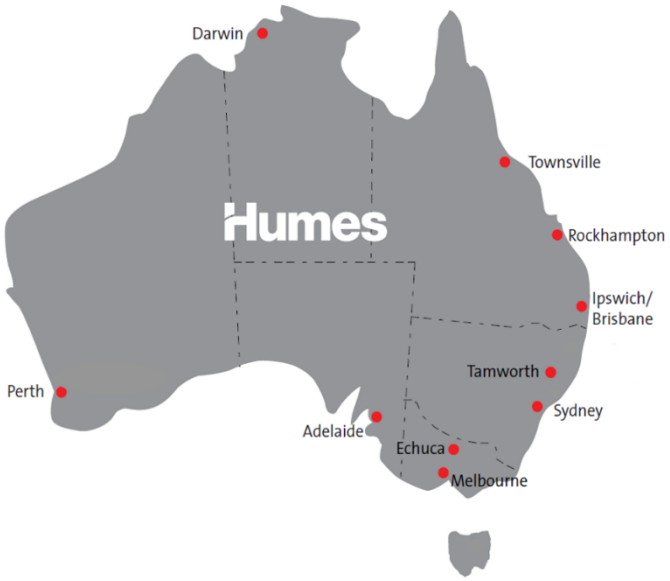
SA 2016 — AS/NZS 3582.1:2016 Supplementary cementitious materials Part 1: Fly Ash, published on 12 February 2016 by Standard Australia, Sydney

SA 2019 — AS/NZS 4671:2019 Steel for the reinforcement of concrete, published on 13 December 2019 by Standards Australia, Sydney

Timm et al 2019 — Timm et al 2019, Sensitivity Analysis of Life Cycle Impacts Distribution Methods Choice Applied to Silica Fume Production, IOP Conf. Ser.: Earth Environ. Sci. 323 012131

Contact information

National sales 1300 361 601
humes.com.au
info@humes.com.au



Head Office

18 Little Cribb St
Milton 4064 QLD
Ph: (07) 3364 2800
Fax: (07) 3364 2963

Queensland

Ipswich/Brisbane
Ph: (07) 3814 9000
Fax: (07) 3814 9014

Rockhampton
Ph: (07) 4924 7900
Fax: (07) 4924 7901

Townsville
Ph: (07) 4758 6000
Fax: (07) 4758 6001

New South Wales

Grafton
Ph: (02) 6644 7666
Fax: (02) 6644 7313

Newcastle
Ph: (02) 4032 6800
Fax: (02) 4032 6822

Sydney
Ph: (02) 9832 5555
Fax: (02) 9625 5200

Tamworth
Ph: (02) 6763 7300
Fax: (02) 6763 7301

Victoria

Echuca
Ph: (03) 5480 2371
Fax: (03) 5482 3090

Melbourne
Ph: (03) 9360 3888
Fax: (03) 9360 3887

South Australia

Adelaide
Ph: (08) 8168 4544
Fax: (08) 8168 4549

Western Australia

Gnangara
Ph: (08) 9302 8000
Fax: (08) 9309 1625

Perth
Ph: (08) 9351 6999
Fax: (08) 9351 6977

Northern Territory

Darwin
Ph: (08) 8984 1600
Fax: (08) 8984 1614

Precast arches

HumeDeck® modular bridge

National sales 1300 361 601
humes.com.au
info@humes.com.au

A Division of Holcim Australia