ViroDecs™ Special

Holcim Australia Ready-Mix Concrete

Queensland – Brisbane – ECOPact Range

Environmental Product Declaration

In accordance with ISO 14025 and EN15804+A1
Programme: The International EPD® System | www.environdec.com
Programme Operator: EPD Australasia Limited | www.epd-australasia.com
Managed by: Holcim Certified EPD Process
EPD Process Certificate No.04
Verified Accreditation Body: Epsten Group, Inc.
EPD Registration No. S-P-04658
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Geographical Scope: Australia

Table of Contents

Reversion Number	Reversion Date	Description of Changes
N/A	N/A	N/A

Introduction

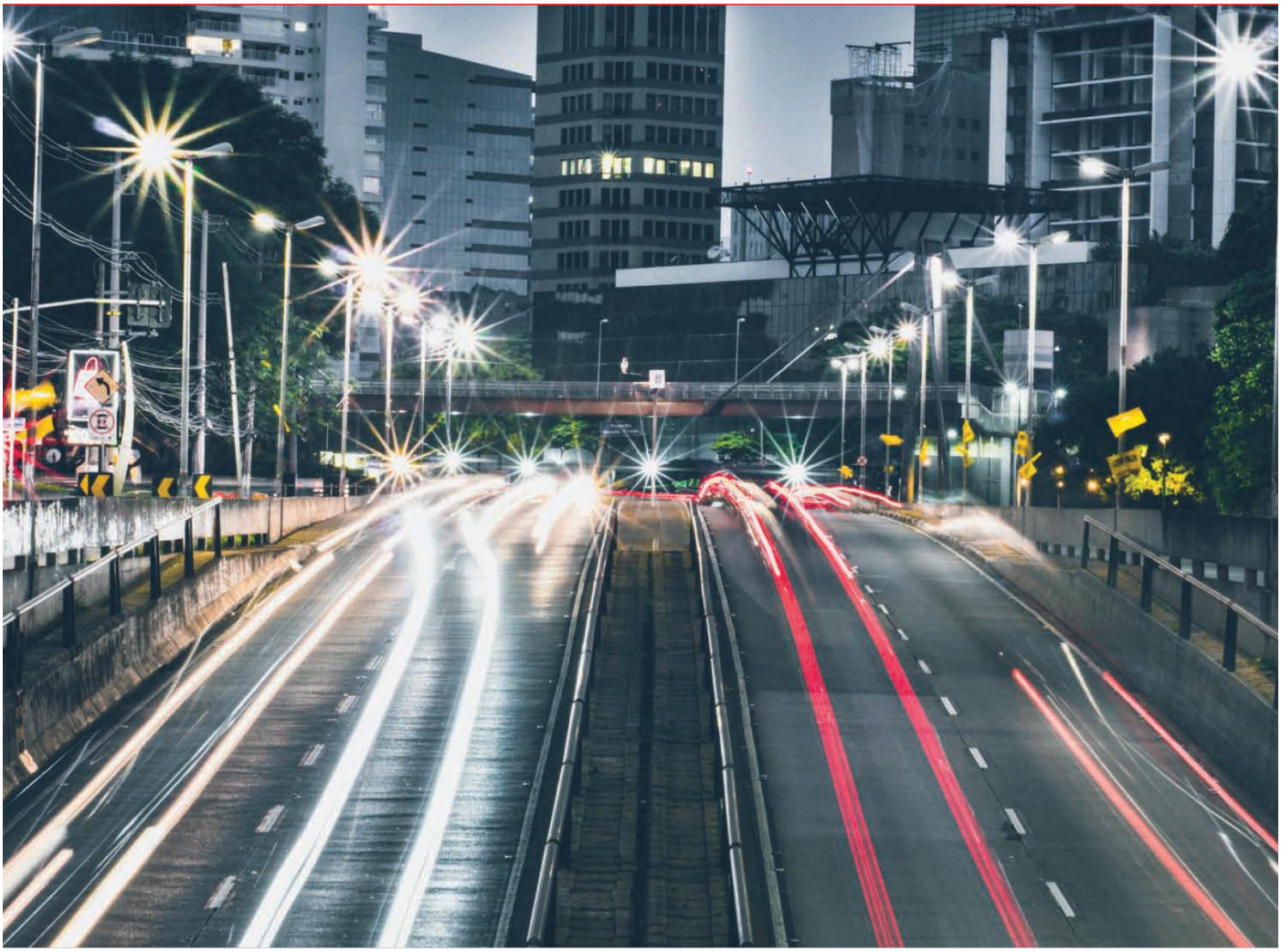
All around the world, the expectation for Governments and organisations to provide enhanced transparency and disclosure of environmental impacts, such as greenhouse gas (GHG) emissions, has been growing. This follows the landmark COP 21 Paris Agreement in 2015 in which all nations agreed to ambitiously pursue efforts to combat climate change and its effects.

At the same time, the global demand for construction materials is also growing due to worldwide population growth and an increase in urbanisation. In fact, concrete is the second most used commodity in the world behind water, and typically a major contributor to the embodied GHG emissions of an infrastructure or property asset.

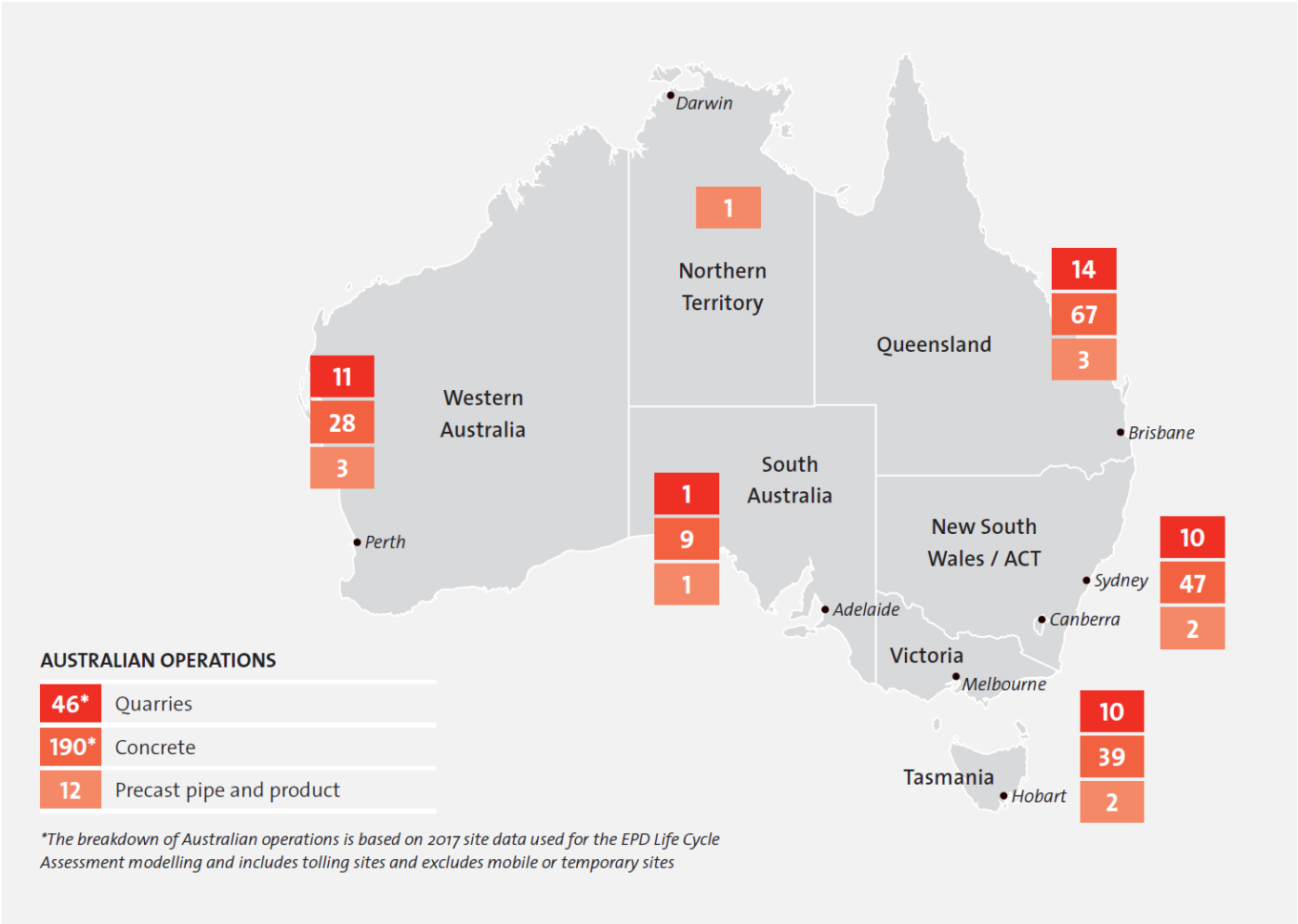
This clearly demonstrates both the essential need for construction materials now and in the future, as well as the necessity for the construction materials industry to be a leading part of the solution addressing climate change.

At Holcim, we recognise our responsibility to contribute to global emissions reduction targets and we have developed a roadmap with a number of actions to direct our efforts.

Our ViroDecs™ range of ready-mix concrete represented by an Environmental Product Declaration (EPD) is one such initiative for Holcim in Australia.



About Holcim



About Holcim

Holcim is a leading supplier of construction materials in Australia, originally serving the industry under the well-known Readymix and Humes brands dating back to 1901. Today Holcim continues to supply essential construction materials including aggregates, sand, ready-mix concrete, engineered precast concrete and prestressed concrete solutions to a range of customers and projects throughout Australia.

Holcim operates right across the Australian continent supplying concrete from a network of concrete plants, quarries, precast and concrete pipe places, and mobile and on-site project facilities.

As part of LafargeHolcim, Holcim Australia can be counted on for state-of-the-art product development, reliable service, and advanced technical expertise for your next project.

About LafargeHolcim

LafargeHolcim is the global leader in building materials and solutions and active in four business segments: Cement, Aggregates, Ready-mix Concrete and Solutions & Products.
With leading positions in all regions of the world and a balanced portfolio between developing and mature markets, LafargeHolcim offers a broad range of high-quality building materials and solutions.

LafargeHolcim experts solve the challenges that customers face around the world, whether they are building individual homes or major infrastructure projects.

Demand for LafargeHolcim materials and solutions is driven by global population growth, urbanisation, improved living standards and sustainable construction. Around 75,000 people work for the company in around 80 countries.

ViroDecs™ Special – a first for ready-mix concrete in Australia

ViroDecs™ Special at a glance

The Holcim ViroDecs™ Special provides project-specific, on-demand Environmental Product Declarations (EPDs) to Holcim's customers. This capability represents a significant step in Holcim's sustainability journey and embodies our multi-disciplinary approach to embedding sustainability into our organisation and operations. With the introduction of our ViroDecs™ Special, third-party verified data will underpin our capability to work with our customers from tender through to design and construction to optimise ready-mix concrete mix designs and report on sustainability performance.

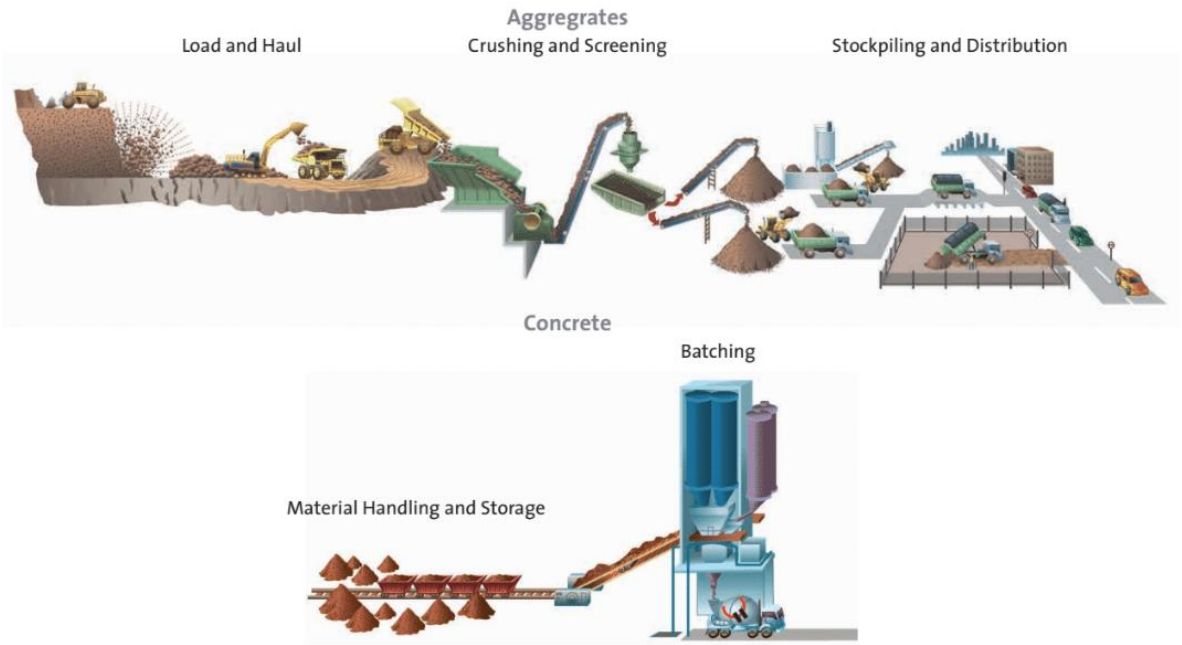
The publication of the original ViroDecs™ EPD in 2019 introduced quality, third-party verified embodied life cycle impact data for ready-mix concrete into the Australian market for the first time. Holcim has been pleased by the positive response from the industry. The message was loud and clear: "we want transparency and we want a evidence-based approach to specification, procurement and reporting". With the introduction of our ViroDecs™ Special, Holcim's customers can specify concrete sustainability performance in terms of CO_2-e, with the confidence that our claims are backed by our third-party verified EPD Process Certification.

Holcim ViroDecs™ Special is backed by an EPD Process Certification. It's not only a first for concrete but a first for any product in Australia. Our EPD Process Certification is a stamp of approval to produce compliant EPDs in-house, opening up significant capability and flexibility in producing and using life cycle impact data to inform our operations and our customers.

To gain our EPD Process Certification, Holcim invested in embedding Life Cycle Assessment (LCA) into our systems and processes. We have satisfied a rigorous, third-party evaluation in accordance with the relevant ISO standards and guidelines of the International EPD Programme and EPD Australasia.

This EPD has been developed using our EPD Process Certification for Holcim's Brisbane ECOPact Range with production occurring at Brisbane region sites.

Ready-mix concrete



Summary of properties and classes

Concrete is prepared by mixing cement, coarse and fine aggregates, and water, with or without the addition of auxiliary agents and additives. The fresh concrete is placed on the building site or prefabricated in factory moulds, compacted and hardened in the desired shape by the hydration of cement to form concrete.

General Australian Standard AS 1379 sets down a number of different ways of specifying and ordering concrete to promote uniformity, efficiency and economy in production and delivery. It refers to two classes of concrete: normal-class and special-class.

- **Normal-class –** designed for residential applications, low rise buildings, paving and driveways etc. Its specification and ordering have been simplified as far as practicable.
- **Special-class –** allows the purchaser to incorporate into the project specification any special requirements for the project. Special-class concrete is typically supplied to major and high-end construction projects from high rise buildings, dams and spillways, roads and bridges to public works infrastructure etc. Special-class concrete is typically specified in accordance with the technical parameters and performance requirements, which can include high-strength/high-performances concrete, high durability or marine application, post-tensioned, high-pumpability, super workable, piling concrete, architectural off-form finishes and other decorative applications.

LCA Information

Declared Unit

1 m^3 of ready-mix concrete.

Reference Service Life (RSL)

The RSL is not specified as the scope is from cradle to gate.

Time Representativeness

The plant data for the LCA is based on 2017 calendar year production data. The mix data for the LCA is based on 2021 calendar year production data.

Databases and LCA Software Used

SimaPro (v8.4) was used for the LCA modelling which developed the LCA Calculator, used as per the certified EPD Process. It uses background data from:

1. The Australian National Life Cycle Inventory Database (AusLCI) (2017)
2. Ecoinvent 3.4 (2017)
3. World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI) Tool Project Database (International Version) (2018); and
4. Product specific EPDs for admixtures and fibres.

The environmental impacts modelled from the CSI tool and existing EPDs do not include impacts for the additional Green Star (v1.2) impact categories included in the environmental impact tables. The following impact categories were calculated manually for the foreground data:

- Use of renewable primary energy resources used as raw materials
- Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
- Use of secondary material
- Use of renewable secondary fuels
- Use of non-renewable secondary fuels

Allocation

Allocation was necessary to proportion inputs and outputs to intermediate flows at the quarry and processes at the batching plant level.
As much as possible, intermediate flows were allocated physically based on weight (quarries) or based on m^2 of concrete (at the batching plant). At the quarry level, whenever physical allocation was not possible, economic allocation was carried out based on Holcim's internal cost system.
Regarding inputs, it was assumed that fly ash and silica fumes are waste products and therefore burden-free. Ground granulated blast furnace slag from steel blast furnace production was allocated economically. Please refer to the "Recycled Material" section for further detail.

Cut-Off Criteria

No flows were excluded on the basis of cut-off criteria.

Address and Contact Information

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Data Quality

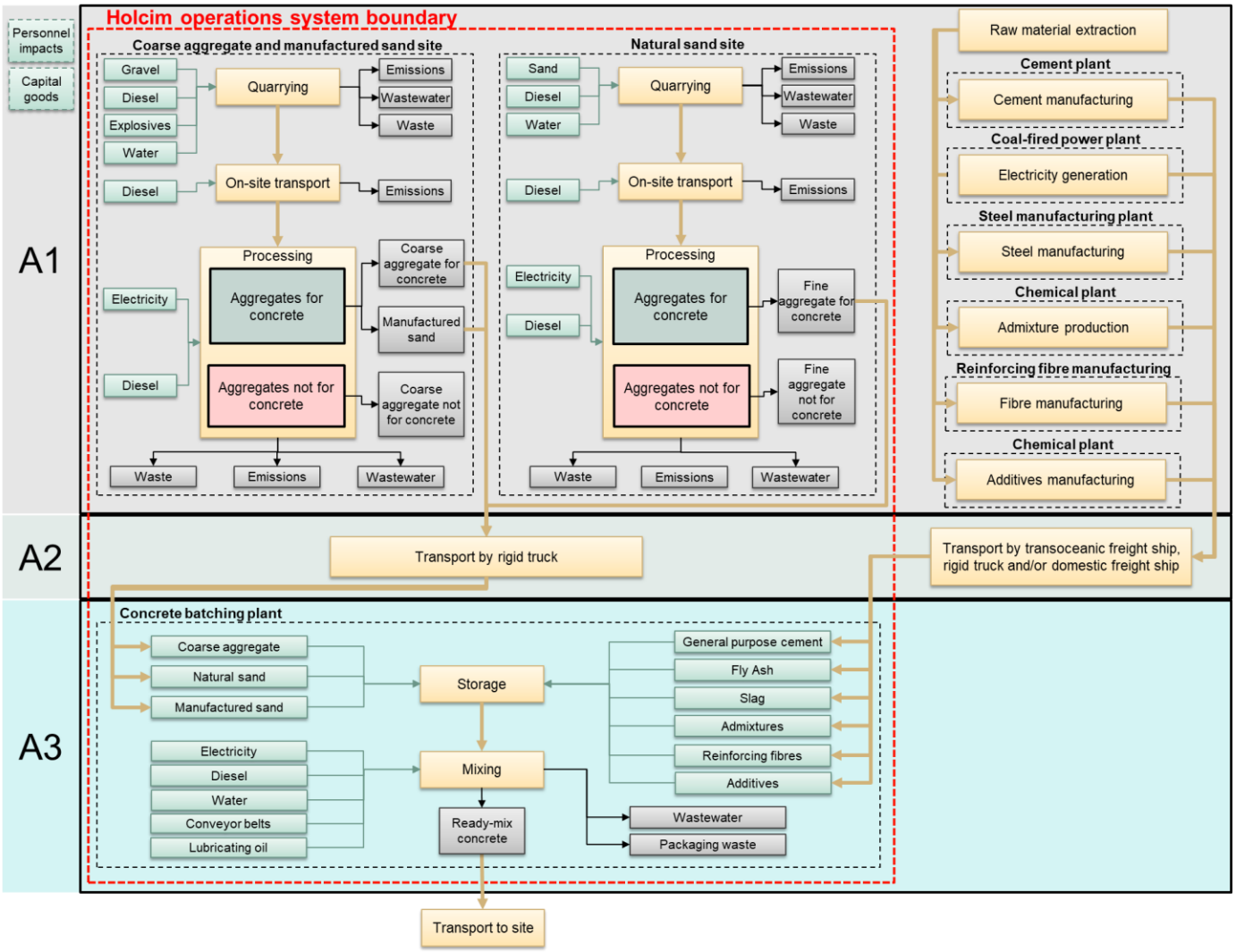
Data quality for the foreground data was assessed in terms of geographic and temporal representativeness. All data sources were scored medium or higher.

Module	Input/outputs	Sub-processes	Data source	Temporal scope	Geographic scope	Quality
A1	Coarse aggregate Manufactured sand Fine aggregate	Electricity	Electricity provider invoices	2017	All states	High
		Diesel	Supplier invoices	2017	All states	High
		Pollutants	National Pollution Inventory (NPI) data	2017	All states	High
		Mains water	Water utility invoices	2017	All states barring NSW	Medium
		Water – other sources (lakes, groundwater, rainwater)	Metered withdrawal data	2017	All states barring NSW	Medium
		Water discharge from site	Measured site data	2017	All states barring NSW	Medium
		Explosives (Manufactured sand and Coarse aggregate only)	Invoices	2017	All states (excluding the Kalgoorlie Quarry in WA which purchases raw feed from an external source)	High
		Gravel	Calculated – spoil + production amount	2017	All states	High
		Spoil	Holcim waste records	2017	All states	High
A2	Aggregate transport	Background data used to model	Actual transport distances and loads per trip	2017	All states (excluding Lynwood Quarry which transports by freight rail)	High
A3	Concrete batching plant	Electricity	Electricity provider invoices	2017	All states	High
		Diesel	Supplier invoices	2017	All states	High
		Mains water	Water metres, with utility invoices as a back-up	2017	All states	High
		Water – other sources (lakes, groundwater, rainwater)	Estimate based on water balance	2017	All states	Medium
		Water discharge from site	Estimate based on Holcim site performance metrics	2017	All states	Medium
		Lubricating oil	AusLCI concrete process	2015	National	Medium
		Conveyor belt				
	Concrete mix designs	Background data used to model	Holcim internal technical database containing mix designs	2017	All states	High
	Packaging waste	Background data used to model	Estimate based on researched packaging material and sizes	N/A	N/A	Medium

Background data sources were also assessed with respect to their timeliness, with all data sources being updated within the 10 years required under PCR 2012:01.

System Diagram

The processes included in the LCA are presented in a process diagram in the figure below.



Description of System Boundaries and Excluded Lifecycle Stages

The scope of the LCA and EPD is from cradle to gate. Life cycle stages beyond Holcim's gate are excluded from the LCA (see figure below).

Environmental impacts relating to personnel, infrastructure and production equipment not directly consumed in the process are excluded from the system boundary as per the Product Category Rules (2012:01 Construction Production and Construction Services).

Product Stage			Construction Stage		Use Stage							End of Life Stage				Benefits & loads for the next product system
Raw Material Supply	Transport	Manufacturing	Transport	Construction/installation process	Use	Maintenance incl. transport	Repair incl. transport	Replacement incl. transport	Refurbishment incl. transport	Operational Energy Use	Operational Water Use	De-construction & demolition	Transport	Re-use recycling	Final Disposal	Reuse, Recovery Recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

*Module not declared (MND)

EPD Product Description and Use

ViroDecs™ Ready-mix concrete – QLD – Brisbane – ECOPact Range

A detailed breakdown of the functional properties of the ready-mix concrete included in this EPD are provided below. Product environmental information should only be compared with consideration of the product's requisite function.

Strength (MPa)	Mix code	Description of use	Strength (MPa)	Mix code	Description of use
20	QE203EBMX / EE203EBMX	S20/3/200 ECOPact Blockmix	40	QE402EEZY / EE402EEZY	S40/20/120 ECOPact 2EZY Concrete
25	QE253EBMX / EE253EBMX	S25/3/200 ECOPact Blockmix	50	QE502EEZY / EE502EEZY	S50/20/120 ECOPact 2EZY Concrete
32	QE323EBMX / EE323EBMX	S32/3/200 ECOPact Blockmix	20	QE201EL21 / EE201EL21	S20/10/100 ECOPact 2 Inch Line Concrete
20	QE207EBMX / EE207EBMX	S20/7/200 ECOPact Blockmix	25	QE251EL21 / EE251EL21	S25/10/100 ECOPact 2 Inch Line Concrete
25	QE257EBMX / EE257EBMX	S25/7/200 ECOPact Blockmix	32	QE321EL21 / EE321EL21	S32/10/100 ECOPact 2 Inch Line Concrete
32	QE327EBMX / EE327EBMX	S32/7/200 ECOPact Blockmix	40	QE401EL21 / EE401EL21	S40/10/100 ECOPact 2 Inch Line Concrete
40	QE407EBMX / EE407EBMX	S40/7/200 ECOPact Blockmix	50	QE501EL21 / EE501EL21	S50/10/100 ECOPact 2 Inch Line Concrete
20	QE202E / EE202E	S20/20/80 ECOPact Concrete	40	QE401E200 / EE401E200	S40/10/200 ECOPact Concrete
25	QE252E / EE252E	S25/20/80 ECOPact Concrete	50	QE501E200 / EE501E200	S50/10/200 ECOPact Concrete
32	QE322E / EE322E	S32/20/80 ECOPact Concrete	40	QE401EDUF / EE401EDUF	S40/10/600 ECOPact UltraFlow Concrete
40	QE402E / EE402E	S40/20/80 ECOPact Concrete	50	QE501EDUF / EE501EDUF	S50/10/620 ECOPact UltraFlow Concrete
50	QE502E / EE502E	S50/20/80 ECOPact Concrete	40	QE402PT1 / EE402PT1	S40/20/100 ECOPact PT Concrete
20	QE201E100 / EE201E100	S20/10/100 ECOPact Concrete	40	QE402PT2 / EE402PT2	S40/20/120 ECOPact PT Concrete
25	QE251E100 / EE251E100	S25/10/100 ECOPact Concrete	40	QE402PT3 / EE402PT3	S40/20/150 ECOPact PT Concrete
32	QE321E100 / EE321E100	S32/10/100 ECOPact Concrete	32	QE322LPN2 / EE322LPN2	S32/20/120 ECOPact Penetron Concrete
40	QE401E100 / EE401E100	S40/10/100 ECOPact Concrete	40	QE402LPN2 / EE402LPN2	S40/20/120 ECOPact Penetron Concrete
50	QE501E100 / EE501E100	S50/10/100 ECOPact Concrete	50	QE502LPN2 / EE502LPN2	S50/20/120 ECOPact Penetron Concrete
20	QE202E100 / EE202E100	S20/20/100 ECOPact Concrete	32	QE327ETOP / EE327ETOP	S32/7/80 ECOPact Topping Concrete
25	QE252E100 / EE252E100	S25/20/100 ECOPact Concrete	32	QE327LSPR / EE327LSPR	S32/7/70 ECOPact Super Spray Concrete
32	QE322E100 / EE322E100	S32/20/100 ECOPact Concrete	40	QE407LSPR / EE407LSPR	S40/7/70 ECOPact Zero Super Spray Concrete
40	QE402E100 / EE402E100	S40/20/100 ECOPact Concrete	32	QE322L652 / EE322L652	S32/20/120 ECOPact 650 Nominal Shrinkage Concrete
50	QE502E100 / EE502E100	S50/20/100 ECOPact Concrete	40	QE402L652 / EE402L652	S40/20/120 ECOPact 650 Nominal Shrinkage Concrete

Note: Some customer invoices may have a Z as the second charterer in their mix code (e.g. QZ202E). This indicates that the mix was sold as a carbon neutral ready-mix concrete (i.e. the residual Global Warming Potential was offset). To find the applicable mix code, please substitute the seconded charter in the mix code with an E (e.g. QE202E).

Strength (MPa)	Mix code	Description of use	Strength (MPa)	Mix code	Description of use
20	QE201EEZY / EE201EEZY	S20/10/120 ECOPact 2EZY Concrete	65	QE651E200 / EE651E200	S65/10/200 ECOPact Concrete
25	QE251EEZY / EE251EEZY	S25/10/120 ECOPact 2EZY Concrete	65	QZ801E200 / EE801E200	S80/10/200 ECOPact Concrete
32	QE321EEZY / EE321EEZY	S32/10/120 ECOPact 2EZY Concrete	80	QE651EDUF / EE651EDUF	S65/10/650 ECOPact UltraFlow Concrete
40	QE401EEZY / EE401EEZY	S40/10/120 ECOPact 2EZY Concrete	80	QE801EDUF / EE801EDUF	S80/10/650 ECOPact UltraFlow Concrete
50	QE501EEZY / EE501EEZY	S50/10/120 ECOPact 2EZY Concrete	40	QE401LMO1 / EE401LMO1	S40/10/100 Mosaic ECOPact Concrete
20	QE202EEZY / EE202EEZY	S20/20/120 ECOPact 2EZY Concrete	40	QE402LMO1 / EE402LMO1	S40/20/100 Mosaic ECOPact Concrete
25	QE252EEZY / EE252EEZY	S25/20/120 ECOPact 2EZY Concrete			
32	QE322EEZY / EE322EEZY	S32/20/120 ECOPact 2EZY Concrete			

Note: Some customer invoices may have a Z as the second charterer in their mix code (e.g. QZ202E). This indicates that the mix was sold as a carbon neutral ready-mix concrete (i.e. the residual Global Warming Potential was offset). To find the applicable mix code, please substitute the seconded charter in the mix code with an E (e.g. QE202E).

Content Declaration

The following table provides a summary of the materials included in Holcim ready-mix concrete and their relative composition by weight.

Material	Content
General purpose cement	5-21%
Aggregate	67-84%
Supplementary cementitious materials	0-11%
Water	11.6-12%
Admixtures	0.01-0.02%

Holcim Ready-mix concrete is classified as Non-Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. The safety data sheet for pre-mixed concrete lists all associated hazard phrases.

The gross weight of this declared material makes up a minimum of 99% of the products covered by this EPD.

Packaging

Holcim ready-mix concrete is delivered in bulk with no packaging.

Recycled Material

BS EN 16757:2017 specifically lists the following materials relevant to the study as co-products:

- Fly ash;
- Ground granulated blast furnace slag; and
- Silica fume

As such, the above materials are considered as co-products of their production process and the impacts for their production process are allocated according to PCR 2012:01 Construction Products and Construction Services (co-produced goods, multi-output allocation).

Default background data from LCA databases was used to model the above co-products:

- Fly ash: AusLCI process for fly ash treats it as a waste material and only includes transport impacts.
- Ground granulated blast furnace slag: the AusLCI process for slag is allocated based on economic value, as the product has a significant economic value at the point of collection.
- Silica fume: the ecoinvent process for silica fume treat it as a waste material and only includes transport impacts.

The allocation approach of the AusLCI LCA database was adopted as a default for secondary data and processes (e.g. secondary fuel in cement production). The AusLCI dataset conforms to EN 15804 when applying allocation to its various processes and sub-processes.

Environmental Performance

The environmental impacts considered in this EPD are listed in the table below. All further tables from this point will contain abbreviation only.

Impact Category	Abbreviation	Measurement Unit
Potential Environmental Impacts		
Global warming potential	GWP	kg CO_2 equivalents (GWP100)
Ozone depletion potential	ODP	kg CFC 11 equivalents
Acidification potential	AP	kg SO_2 equivalents
Eutrophication Potential	EP	kg PO_4^{3-} equivalents
Photochemical ozone creation potential	POCP	kg C_2H_2 equivalents
Abiotic depletion potential (elements)	ADPE	kg Sb equivalents
Abiotic depletion potential (fossil fuels)	ADPF	MJ net calorific value
Resource use		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	PERM	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PERT	MJ, net calorific value
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ, net calorific value
Use of non- renewable primary energy resources used as raw materials	PENRM	MJ, net calorific value
Total use of non- renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PENRT	MJ, net calorific value
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ, net calorific value
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value
Use of net fresh water	FW	m^3
Output categories		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed/stored	RWD	kg
Components for reuse	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy	EE	MJ per energy carrier
Optional Green Star (v1.2) indicators		
Human Toxicity	HT	CTUh
Land use	LU	m^2
Water stress indicator	WSI	m^3
Ionising radiation	IR	kBq U235 eq
Particulate matter	PM	kg PM2.5 eq

QLD – Brisbane – ECOPact Range

1m^3 of ViroDecs™ ready-mix concrete – Primary indicators

PRIMARY INDICATORS		GWP	ODP	AP	EP	POCP	ADPE	ADPF
Strength (MPa)	Mix Code	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg PO_4^{3-} eq	kg C_2H_4 eq	kg Sb eq	MJ
20	QE203EBMX / EE203EBMX	219.63	4.20E-06	6.81E-01	1.24E-01	2.51E-02	1.28E-04	1.87E+03
25	QE253EBMX / EE253EBMX	231.17	4.38E-06	7.15E-01	1.30E-01	2.63E-02	1.34E-04	1.96E+03
32	QE323EBMX / EE323EBMX	269.56	4.98E-06	8.32E-01	1.50E-01	3.03E-02	1.53E-04	2.26E+03
20	QE207EBMX / EE207EBMX	197.03	3.97E-06	6.03E-01	1.12E-01	2.22E-02	1.22E-04	1.66E+03
25	QE257EBMX / EE257EBMX	213.12	4.25E-06	6.59E-01	1.21E-01	2.40E-02	1.30E-04	1.79E+03
32	QE327EBMX / EE327EBMX	236.21	4.63E-06	7.37E-01	1.33E-01	2.66E-02	1.41E-04	1.97E+03
40	QE407EBMX / EE407EBMX	266.95	5.14E-06	8.32E-01	1.50E-01	2.99E-02	1.57E-04	2.23E+03
20	QE202E / EE202E	157.89	3.47E-06	5.03E-01	9.39E-02	1.89E-02	1.04E-04	1.39E+03
25	QE252E / EE252E	169.47	3.66E-06	5.39E-01	9.98E-02	2.00E-02	1.10E-04	1.47E+03
32	QE322E/ EE322E	187.29	3.97E-06	5.94E-01	1.09E-01	2.17E-02	1.19E-04	1.60E+03
40	QE402E / EE402E	225.61	4.58E-06	7.12E-01	1.29E-01	2.55E-02	1.38E-04	1.89E+03
50	QE502E / EE502E	293.71	5.64E-06	9.20E-01	1.64E-01	3.23E-02	1.71E-04	2.39E+03
20	QE201E100 / EE201E100	162.92	3.50E-06	5.17E-01	9.59E-02	1.93E-02	1.05E-04	1.42E+03
25	QE251E100 / EE251E100	171.22	3.64E-06	5.43E-01	1.00E-01	2.02E-02	1.10E-04	1.48E+03
32	QE321E100 / EE321E100	197.56	4.08E-06	6.25E-01	1.14E-01	2.27E-02	1.23E-04	1.68E+03
40	QE401E100 / EE401E100	237.86	4.72E-06	7.49E-01	1.35E-01	2.67E-02	1.42E-04	1.98E+03
50	QE501E100 / EE501E100	309.69	5.84E-06	9.67E-01	1.72E-01	3.38E-02	1.77E-04	2.51E+03
20	QE202E100 / EE202E100	159.93	3.50E-06	5.10E-01	9.49E-02	1.91E-02	1.05E-04	1.40E+03
25	QE252E100 / EE252E100	171.56	3.69E-06	5.46E-01	1.01E-01	2.03E-02	1.11E-04	1.49E+03
32	QE322E100 / EE322E100	191.80	4.04E-06	6.09E-01	1.12E-01	2.21E-02	1.21E-04	1.64E+03
40	QE402E100 / EE402E100	230.82	4.64E-06	7.27E-01	1.32E-01	2.60E-02	1.40E-04	1.92E+03
50	QE502E100 / EE502E100	300.68	5.76E-06	9.43E-01	1.68E-01	3.30E-02	1.74E-04	2.44E+03
20	QE201EEZY / EE201EEZY	167.70	3.57E-06	5.31E-01	9.83E-02	1.98E-02	1.08E-04	1.46E+03
25	QE251EEZY / EE251EEZY	182.13	3.84E-06	5.79E-01	1.06E-01	2.15E-02	1.15E-04	1.57E+03
32	QE321EEZY / EE321EEZY	200.05	4.12E-06	6.33E-01	1.16E-01	2.30E-02	1.24E-04	1.70E+03
40	QE401EEZY / EE401EEZY	240.75	4.74E-06	7.56E-01	1.36E-01	2.69E-02	1.43E-04	1.99E+03
50	QE501EEZY/ EE501EEZY	314.36	5.91E-06	9.83E-01	1.74E-01	3.43E-02	1.79E-04	2.54E+03
20	QE202EEZY / EE202EEZY	164.90	3.57E-06	5.24E-01	9.74E-02	1.96E-02	1.07E-04	1.44E+03
25	QE252EEZY / EE252EEZY	177.70	3.81E-06	5.65E-01	1.04E-01	2.10E-02	1.14E-04	1.54E+03

PRIMARY INDICATORS		GWP	ODP	AP	EP	POCP	ADPE	ADPF
Strength (MPa)	Mix Code	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg PO_4^{3-} eq	kg C_2H_4 eq	kg Sb eq	MJ
32	QE322EEZY / EE322EEZY	194.38	4.06E-06	6.16E-01	1.13E-01	2.24E-02	1.22E-04	1.66E+03
40	QE402EEZY / EE402EEZY	233.68	4.68E-06	7.36E-01	1.33E-01	2.63E-02	1.41E-04	1.95E+03
50	QE502EEZY / EE502EEZY	306.64	5.83E-06	9.60E-01	1.71E-01	3.36E-02	1.77E-04	2.49E+03
20	QE201EL21 / EE201EL21	167.15	3.54E-06	5.28E-01	9.79E-02	1.98E-02	1.07E-04	1.46E+03
25	QE251EL21 / EE251EL21	182.75	3.83E-06	5.80E-01	1.07E-01	2.16E-02	1.15E-04	1.58E+03
32	QE321EL21 / EE321EL21	205.00	4.17E-06	6.46E-01	1.18E-01	2.34E-02	1.26E-04	1.74E+03
40	QE401EL21 / EE401EL21	246.68	4.82E-06	7.74E-01	1.39E-01	2.76E-02	1.46E-04	2.05E+03
50	QE501EL21 / EE501EL21	318.39	5.95E-06	9.94E-01	1.76E-01	3.48E-02	1.80E-04	2.58E+03
40	QE401E200 / EE401E200	238.91	4.73E-06	7.52E-01	1.36E-01	2.69E-02	1.43E-04	1.99E+03
50	QE501E200 / EE501E200	341.74	5.51E-06	9.45E-01	1.79E-01	3.20E-02	1.84E-04	2.60E+03
40	QE401EDUF / EE401EDUF	260.23	5.03E-06	8.13E-01	1.47E-01	2.92E-02	1.53E-04	2.17E+03
50	QE501EDUF / EE501EDUF	287.08	5.44E-06	8.94E-01	1.60E-01	3.18E-02	1.66E-04	2.37E+03
40	QE402PT1 / EE402PT1	299.18	4.33E-06	7.45E-01	1.53E-01	2.45E-02	1.56E-04	2.17E+03
40	QE402PT2 / EE402PT2	299.56	4.31E-06	7.45E-01	1.53E-01	2.45E-02	1.56E-04	2.18E+03
40	QE402PT3 / EE402PT3	301.15	4.33E-06	7.49E-01	1.53E-01	2.48E-02	1.57E-04	2.20E+03
32	QE322LPN2 / EE322LPN2	265.99	3.60E-06	5.97E-01	1.31E-01	2.16E-02	3.51E-04	2.01E+03
40	QE402LPN2 / EE402LPN2	293.91	3.85E-06	6.54E-01	1.43E-01	2.35E-02	3.88E-04	2.19E+03
50	QE502LPN2 / EE502LPN2	401.71	4.82E-06	8.74E-01	1.89E-01	3.06E-02	5.32E-04	2.91E+03
32	QE327ETOP / EE327ETOP	262.46	4.23E-06	6.96E-01	1.38E-01	2.39E-02	1.45E-04	2.01E+03
32	QE327LSPR / EE327LSPR	281.75	3.70E-06	6.17E-01	1.37E-01	2.03E-02	1.47E-04	1.98E+03
40	QE407LSPR / EE407LSPR	330.82	4.16E-06	7.16E-01	1.59E-01	2.31E-02	1.68E-04	2.29E+03
32	QE322L652 / EE322L652	234.46	3.34E-06	5.24E-01	1.17E-01	1.74E-02	1.29E-04	1.69E+03
40	QE402L652 / EE402L652	284.52	3.80E-06	6.24E-01	1.39E-01	2.02E-02	1.50E-04	1.99E+03
65	QE651E200 / EE651E200	359.05	5.74E-06	9.90E-01	1.88E-01	3.35E-02	1.92E-04	2.72E+03
80	QE801E200 / EE801E200	425.11	6.64E-06	1.17E+00	2.20E-01	3.92E-02	2.23E-04	3.19E+03
65	QE651EDUF / EE651EDUF	362.21	5.75E-06	9.96E-01	1.89E-01	3.40E-02	1.93E-04	2.77E+03
80	QE801EDUF / EE801EDUF	428.84	6.65E-06	1.18E+00	2.22E-01	3.98E-02	2.24E-04	3.24E+03
40	QE401LMO1 / EE401LMO1	318.33	4.01E-06	6.94E-01	1.54E-01	2.20E-02	1.62E-04	2.19E+03
40	QE402LMO1 / EE402LMO1	307.87	3.90E-06	6.72E-01	1.49E-01	2.13E-02	1.57E-04	2.12E+03

Note: Some customer invoices may have a Z as the second charterer in their mix code (e.g. QZ202E). This indicates that the mix was sold as a carbon neutral ready-mix concrete (i.e. the residual Global Warming Potential was offset). To find the applicable mix code, please substitute the seconded charter in the mix code with an E (e.g. QE202E).

1m^3 of ViroDecs™ ready-mix concrete – Resource use parameters

PARAMETERS DESCRIBING RESOURCE USE		PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
Strength (MPa)	Mix Code	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	kg	MJ_{NCV}	MJ_{NCV}	m^3
20	QE203EBMX / EE203EBMX	3.15E+01	0.00E+00	3.15E+01	1.04E+03	1.79E+02	1.22E+03	1.89E+02	0.00E+00	0.00E+00	9.08E-01
25	QE253EBMX / EE253EBMX	3.28E+01	0.00E+00	3.28E+01	1.10E+03	1.77E+02	1.27E+03	2.00E+02	0.00E+00	0.00E+00	9.23E-01
32	QE323EBMX / EE323EBMX	3.74E+01	0.00E+00	3.74E+01	1.30E+03	1.71E+02	1.47E+03	2.39E+02	0.00E+00	0.00E+00	9.76E-01
20	QE207EBMX / EE207EBMX	2.75E+01	0.00E+00	2.75E+01	9.47E+02	1.39E+02	1.09E+03	1.73E+02	0.00E+00	0.00E+00	9.00E-01
25	QE257EBMX / EE257EBMX	2.96E+01	0.00E+00	2.96E+01	1.03E+03	1.35E+02	1.16E+03	1.89E+02	0.00E+00	0.00E+00	9.22E-01
32	QE327EBMX / EE327EBMX	3.26E+01	0.00E+00	3.26E+01	1.14E+03	1.30E+02	1.27E+03	2.11E+02	0.00E+00	0.00E+00	9.54E-01
40	QE407EBMX / EE407EBMX	3.65E+01	0.00E+00	3.65E+01	1.32E+03	1.36E+02	1.45E+03	2.39E+02	0.00E+00	0.00E+00	1.01E+00
20	QE202E / EE202E	2.33E+01	0.00E+00	2.33E+01	7.85E+02	1.45E+02	9.30E+02	1.29E+02	0.00E+00	0.00E+00	8.63E-01
25	QE252E / EE252E	2.47E+01	0.00E+00	2.47E+01	8.41E+02	1.41E+02	9.81E+02	1.42E+02	0.00E+00	0.00E+00	8.77E-01
32	QE322E/ EE322E	2.70E+01	0.00E+00	2.70E+01	9.15E+02	1.41E+02	1.06E+03	1.60E+02	0.00E+00	0.00E+00	9.11E-01
40	QE402E / EE402E	3.16E+01	0.00E+00	3.16E+01	1.10E+03	1.29E+02	1.23E+03	2.01E+02	0.00E+00	0.00E+00	9.62E-01
50	QE502E / EE502E	3.97E+01	0.00E+00	3.97E+01	1.42E+03	1.10E+02	1.53E+03	2.72E+02	0.00E+00	0.00E+00	1.05E+00
20	QE201E100 / EE201E100	2.39E+01	0.00E+00	2.39E+01	8.05E+02	1.41E+02	9.46E+02	1.35E+02	0.00E+00	0.00E+00	8.52E-01
25	QE251E100 / EE251E100	2.49E+01	0.00E+00	2.49E+01	8.45E+02	1.39E+02	9.84E+02	1.45E+02	0.00E+00	0.00E+00	8.63E-01
32	QE321E100 / EE321E100	2.83E+01	0.00E+00	2.83E+01	9.60E+02	1.37E+02	1.10E+03	1.73E+02	0.00E+00	0.00E+00	9.06E-01
40	QE401E100 / EE401E100	3.31E+01	0.00E+00	3.31E+01	1.15E+03	1.25E+02	1.28E+03	2.15E+02	0.00E+00	0.00E+00	9.60E-01
50	QE501E100 / EE501E100	4.17E+01	0.00E+00	4.17E+01	1.49E+03	1.07E+02	1.59E+03	2.89E+02	0.00E+00	0.00E+00	1.06E+00
20	QE202E100 / EE202E100	2.35E+01	0.00E+00	2.35E+01	7.96E+02	1.42E+02	9.38E+02	1.32E+02	0.00E+00	0.00E+00	8.63E-01
25	QE252E100 / EE252E100	2.49E+01	0.00E+00	2.49E+01	8.52E+02	1.38E+02	9.90E+02	1.45E+02	0.00E+00	0.00E+00	8.78E-01
32	QE322E100 / EE322E100	2.75E+01	0.00E+00	2.75E+01	9.39E+02	1.37E+02	1.08E+03	1.66E+02	0.00E+00	0.00E+00	9.15E-01
40	QE402E100 / EE402E100	3.21E+01	0.00E+00	3.21E+01	1.12E+03	1.26E+02	1.25E+03	2.06E+02	0.00E+00	0.00E+00	9.66E-01
50	QE502E100 / EE502E100	4.06E+01	0.00E+00	4.06E+01	1.45E+03	1.06E+02	1.56E+03	2.81E+02	0.00E+00	0.00E+00	1.06E+00
20	QE201EEZY / EE201EEZY	2.45E+01	0.00E+00	2.45E+01	8.26E+02	1.41E+02	9.67E+02	1.40E+02	0.00E+00	0.00E+00	8.56E-01
25	QE251EEZY / EE251EEZY	2.64E+01	0.00E+00	2.64E+01	8.99E+02	1.43E+02	1.04E+03	1.57E+02	0.00E+00	0.00E+00	8.86E-01
32	QE321EEZY / EE321EEZY	2.86E+01	0.00E+00	2.86E+01	9.72E+02	1.38E+02	1.11E+03	1.76E+02	0.00E+00	0.00E+00	9.10E-01
40	QE401EEZY / EE401EEZY	3.33E+01	0.00E+00	3.33E+01	1.16E+03	1.24E+02	1.28E+03	2.17E+02	0.00E+00	0.00E+00	9.60E-01
50	QE501EEZY/ EE501EEZY	4.23E+01	0.00E+00	4.23E+01	1.51E+03	1.05E+02	1.62E+03	2.95E+02	0.00E+00	0.00E+00	1.06E+00
20	QE202EEZY / EE202EEZY	2.42E+01	0.00E+00	2.42E+01	8.17E+02	1.43E+02	9.61E+02	1.37E+02	0.00E+00	0.00E+00	8.67E-01
25	QE252EEZY / EE252EEZY	2.59E+01	0.00E+00	2.59E+01	8.81E+02	1.45E+02	1.03E+03	1.51E+02	0.00E+00	0.00E+00	8.94E-01
32	QE322EEZY / EE322EEZY	2.79E+01	0.00E+00	2.79E+01	9.48E+02	1.40E+02	1.09E+03	1.68E+02	0.00E+00	0.00E+00	9.16E-01
40	QE402EEZY / EE402EEZY	3.26E+01	0.00E+00	3.26E+01	1.13E+03	1.29E+02	1.26E+03	2.09E+02	0.00E+00	0.00E+00	9.68E-01
50	QE502EEZY / EE502EEZY	4.13E+01	0.00E+00	4.13E+01	1.48E+03	1.08E+02	1.59E+03	2.86E+02	0.00E+00	0.00E+00	1.06E+00

PARAMETERS DESCRIBING RESOURCE USE		PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
Strength (MPa)	Mix Code	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	MJ_{NCV}	kg	MJ_{NCV}	MJ_{NCV}	m^3
20	QE201EL21 / EE201EL21	2.45E+01	0.00E+00	2.45E+01	8.19E+02	1.48E+02	9.67E+02	1.39E+02	0.00E+00	0.00E+00	8.53E-01
25	QE251EL21 / EE251EL21	2.66E+01	0.00E+00	2.66E+01	8.98E+02	1.50E+02	1.05E+03	1.57E+02	0.00E+00	0.00E+00	8.84E-01
32	QE321EL21 / EE321EL21	2.93E+01	0.00E+00	2.93E+01	9.89E+02	1.43E+02	1.13E+03	1.79E+02	0.00E+00	0.00E+00	9.14E-01
40	QE401EL21 / EE401EL21	3.43E+01	0.00E+00	3.43E+01	1.19E+03	1.31E+02	1.32E+03	2.23E+02	0.00E+00	0.00E+00	9.68E-01
50	QE501EL21 / EE501EL21	4.28E+01	0.00E+00	4.28E+01	1.52E+03	1.10E+02	1.64E+03	2.98E+02	0.00E+00	0.00E+00	1.06E+00
40	QE401E200 / EE401E200	3.34E+01	0.00E+00	3.34E+01	1.15E+03	1.33E+02	1.29E+03	2.15E+02	0.00E+00	0.00E+00	9.66E-01
50	QE501E200 / EE501E200	4.28E+01	0.00E+00	4.28E+01	1.46E+03	1.18E+02	1.58E+03	2.32E+02	0.00E+00	0.00E+00	1.09E+00
40	QE401EDUF / EE401EDUF	3.61E+01	0.00E+00	3.61E+01	1.27E+03	1.39E+02	1.41E+03	2.34E+02	0.00E+00	0.00E+00	9.93E-01
50	QE501EDUF / EE501EDUF	3.93E+01	0.00E+00	3.93E+01	1.39E+03	1.33E+02	1.53E+03	2.61E+02	0.00E+00	0.00E+00	1.03E+00
40	QE402PT1 / EE402PT1	3.58E+01	0.00E+00	3.58E+01	1.14E+03	1.30E+02	1.27E+03	1.13E+02	0.00E+00	0.00E+00	1.04E+00
40	QE402PT2 / EE402PT2	3.59E+01	0.00E+00	3.59E+01	1.14E+03	1.31E+02	1.27E+03	1.13E+02	0.00E+00	0.00E+00	1.03E+00
40	QE402PT3 / EE402PT3	3.62E+01	0.00E+00	3.62E+01	1.16E+03	1.36E+02	1.29E+03	1.13E+02	0.00E+00	0.00E+00	1.04E+00
32	QE322LPN2 / EE322LPN2	2.96E+01	0.00E+00	2.96E+01	1.11E+03	1.35E+02	1.24E+03	9.90E+01	0.00E+00	0.00E+00	9.67E-01
40	QE402LPN2 / EE402LPN2	3.21E+01	0.00E+00	3.21E+01	1.22E+03	1.29E+02	1.34E+03	1.11E+02	0.00E+00	0.00E+00	9.98E-01
50	QE502LPN2 / EE502LPN2	4.17E+01	0.00E+00	4.17E+01	1.64E+03	1.05E+02	1.75E+03	1.58E+02	0.00E+00	0.00E+00	1.12E+00
32	QE327ETOP / EE327ETOP	3.33E+01	0.00E+00	3.33E+01	1.07E+03	1.48E+02	1.22E+03	1.44E+02	0.00E+00	0.00E+00	9.89E-01
32	QE327LSPR / EE327LSPR	3.18E+01	0.00E+00	3.18E+01	9.89E+02	1.40E+02	1.13E+03	1.15E+02	0.00E+00	0.00E+00	9.72E-01
40	QE407LSPR / EE407LSPR	3.65E+01	0.00E+00	3.65E+01	1.15E+03	1.36E+02	1.28E+03	1.35E+02	0.00E+00	0.00E+00	1.04E+00
32	QE322L652 / EE322L652	2.73E+01	0.00E+00	2.73E+01	8.41E+02	1.38E+02	9.79E+02	8.90E+01	0.00E+00	0.00E+00	9.28E-01
40	QE402L652 / EE402L652	3.19E+01	0.00E+00	3.19E+01	1.00E+03	1.27E+02	1.13E+03	1.11E+02	0.00E+00	0.00E+00	9.86E-01
65	QE651E200 / EE651E200	4.47E+01	0.00E+00	4.47E+01	1.53E+03	1.14E+02	1.65E+03	2.45E+02	0.00E+00	0.00E+00	1.11E+00
80	QE801E200 / EE801E200	5.21E+01	0.00E+00	5.21E+01	1.82E+03	1.03E+02	1.92E+03	2.95E+02	0.00E+00	0.00E+00	1.21E+00
65	QE651EDUF / EE651EDUF	4.52E+01	0.00E+00	4.52E+01	1.56E+03	1.26E+02	1.69E+03	2.45E+02	0.00E+00	0.00E+00	1.11E+00
80	QE801EDUF / EE801EDUF	5.27E+01	0.00E+00	5.27E+01	1.85E+03	1.16E+02	1.97E+03	2.95E+02	0.00E+00	0.00E+00	1.21E+00
40	QE401LMO1 / EE401LMO1	3.52E+01	0.00E+00	3.52E+01	1.10E+03	1.29E+02	1.23E+03	9.00E+01	0.00E+00	0.00E+00	1.05E+00
40	QE402LMO1 / EE402LMO1	3.41E+01	0.00E+00	3.41E+01	1.06E+03	1.27E+02	1.19E+03	8.50E+01	0.00E+00	0.00E+00	1.03E+00

Note: Some customer invoices may have a Z as the second charterer in their mix code (e.g. QZ202E). This indicates that the mix was sold as a carbon neutral ready-mix concrete (i.e. the residual Global Warming Potential was offset). To find the applicable mix code, please substitute the seconded charter in the mix code with an E (e.g. QE202E).

1m^3 of ViroDecs™ ready-mix concrete – Waste categories and output flows

WASTE CATEGORIES AND OUTPUT FLOWS		HWD	NHWD	RWD	CRU	MFR	MER	EE
Strength (MPa)	Mix Code	kg	kg	kg	kg	kg	kg	MJ
20	QE203EBMX / EE203EBMX	1.07E-03	6.46E+00	6.98E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE253EBMX / EE253EBMX	1.11E-03	6.71E+00	7.11E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE323EBMX / EE323EBMX	1.26E-03	7.53E+00	7.56E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE207EBMX / EE207EBMX	1.03E-03	6.18E+00	6.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE257EBMX / EE257EBMX	1.10E-03	6.52E+00	7.09E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE327EBMX / EE327EBMX	1.20E-03	7.02E+00	7.35E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE407EBMX / EE407EBMX	1.33E-03	7.73E+00	7.88E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202E / EE202E	9.24E-04	5.39E+00	6.59E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252E / EE252E	9.69E-04	5.64E+00	6.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322E/ EE322E	1.05E-03	6.08E+00	7.01E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402E / EE402E	1.20E-03	6.92E+00	7.43E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE502E / EE502E	1.46E-03	8.40E+00	8.17E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE201E100 / EE201E100	9.25E-04	5.42E+00	6.49E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251E100 / EE251E100	9.59E-04	5.60E+00	6.58E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321E100 / EE321E100	1.07E-03	6.22E+00	6.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401E100 / EE401E100	1.23E-03	7.10E+00	7.40E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE501E100 / EE501E100	1.50E-03	8.67E+00	8.20E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202E100 / EE202E100	9.32E-04	5.42E+00	6.59E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252E100 / EE252E100	9.79E-04	5.68E+00	6.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322E100 / EE322E100	1.07E-03	6.17E+00	7.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402E100 / EE402E100	1.22E-03	7.02E+00	7.46E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE502E100 / EE502E100	1.49E-03	8.55E+00	8.23E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE201EEZY / EE201EEZY	9.40E-04	5.51E+00	6.52E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251EEZY / EE251EEZY	1.01E-03	5.88E+00	6.78E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321EEZY / EE321EEZY	1.08E-03	6.28E+00	6.98E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401EEZY / EE401EEZY	1.23E-03	7.14E+00	7.40E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE501EEZY/ EE501EEZY	1.52E-03	8.76E+00	8.22E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202EEZY / EE202EEZY	9.45E-04	5.52E+00	6.62E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252EEZY / EE252EEZY	1.01E-03	5.85E+00	6.86E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322EEZY / EE322EEZY	1.07E-03	6.22E+00	7.05E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402EEZY / EE402EEZY	1.22E-03	7.07E+00	7.48E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE502EEZY / EE502EEZY	1.51E-03	8.66E+00	8.27E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00

WASTE CATEGORIES AND OUTPUT FLOWS		HWD	NHWD	RWD	CRU	MFR	MER	EE
Strength (MPa)	Mix Code	kg	kg	kg	kg	kg	kg	MJ
20	QE201EL21 / EE201EL21	9.28E-04	5.48E+00	6.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251EL21 / EE251EL21	1.00E-03	5.87E+00	6.78E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321EL21 / EE321EL21	1.09E-03	6.36E+00	7.02E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401EL21 / EE401EL21	1.25E-03	7.27E+00	7.47E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE501EL21 / EE501EL21	1.53E-03	8.82E+00	8.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401E200 / EE401E200	1.23E-03	7.14E+00	7.46E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE501E200 / EE501E200	1.40E-03	9.03E+00	8.42E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401EDUF / EE401EDUF	1.29E-03	7.56E+00	7.69E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE501EDUF / EE501EDUF	1.40E-03	8.14E+00	8.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402PT1 / EE402PT1	1.12E-03	7.90E+00	7.95E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402PT2 / EE402PT2	1.11E-03	7.87E+00	7.89E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402PT3 / EE402PT3	1.11E-03	7.90E+00	7.92E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322LPN2 / EE322LPN2	8.93E-04	7.07E+00	7.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402LPN2 / EE402LPN2	9.47E-04	7.59E+00	7.62E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
50	QE502LPN2 / EE502LPN2	1.16E-03	9.62E+00	8.60E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE327ETOP / EE327ETOP	1.08E-03	7.30E+00	7.59E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE327LSPR / EE327LSPR	9.00E-04	7.78E+00	7.38E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE407LSPR / EE407LSPR	1.00E-03	8.76E+00	7.93E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322L652 / EE322L652	8.33E-04	6.55E+00	7.05E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402L652 / EE402L652	9.32E-04	7.52E+00	7.51E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
65	QE651E200 / EE651E200	1.46E-03	9.39E+00	8.60E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
80	QE801E200 / EE801E200	1.68E-03	1.08E+01	9.41E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
65	QE651EDUF / EE651EDUF	1.45E-03	9.41E+00	8.64E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
80	QE801EDUF / EE801EDUF	1.67E-03	1.08E+01	9.46E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401LMO1 / EE401LMO1	1.00E-03	8.11E+00	7.97E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402LMO1 / EE402LMO1	9.76E-04	7.88E+00	7.80E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Note: Some customer invoices may have a Z as the second charterer in their mix code (e.g. QZ202E). This indicates that the mix was sold as a carbon neutral ready-mix concrete (i.e. the residual Global Warming Potential was offset). To find the applicable mix code, please substitute the seconded charter in the mix code with an E (e.g. QE202E).

1m^3 of ViroDecs™ ready-mix concrete – Green Star As Built v1.2 optional indicators

GREEN STAR INDICATORS		HT	LU	WSI	IR	PM
Strength (MPa)	Mix Code	CTUh	m^2	m^3	kBq U235 eq	kg PM2.5 eq
20	QE203EBMX / EE203EBMX	7.25E-09	1.61E-02	6.64E-01	5.06E-02	3.54E-01
25	QE253EBMX / EE253EBMX	7.64E-09	1.68E-02	6.98E-01	5.15E-02	3.58E-01
32	QE323EBMX / EE323EBMX	8.86E-09	1.92E-02	8.06E-01	5.47E-02	3.75E-01
20	QE207EBMX / EE207EBMX	6.74E-09	1.50E-02	6.10E-01	5.01E-02	3.12E-01
25	QE257EBMX / EE257EBMX	7.28E-09	1.61E-02	6.56E-01	5.14E-02	3.18E-01
32	QE327EBMX / EE327EBMX	8.05E-09	1.77E-02	7.23E-01	5.32E-02	3.27E-01
40	QE407EBMX / EE407EBMX	8.99E-09	1.97E-02	8.08E-01	5.70E-02	3.54E-01
20	QE202E / EE202E	5.46E-09	1.30E-02	4.96E-01	4.78E-02	2.99E-01
25	QE252E / EE252E	5.85E-09	1.37E-02	5.29E-01	4.87E-02	3.02E-01
32	QE322E/ EE322E	6.46E-09	1.50E-02	5.84E-01	5.08E-02	3.15E-01
40	QE402E / EE402E	7.75E-09	1.74E-02	6.96E-01	5.38E-02	3.27E-01
50	QE502E / EE502E	1.00E-08	2.18E-02	8.96E-01	5.91E-02	3.48E-01
20	QE201E100 / EE201E100	5.61E-09	1.31E-02	5.08E-01	4.71E-02	2.96E-01
25	QE251E100 / EE251E100	5.88E-09	1.37E-02	5.32E-01	4.77E-02	2.98E-01
32	QE321E100 / EE321E100	6.77E-09	1.55E-02	6.11E-01	5.04E-02	3.14E-01
40	QE401E100 / EE401E100	8.13E-09	1.81E-02	7.30E-01	5.36E-02	3.26E-01
50	QE501E100 / EE501E100	1.05E-08	2.26E-02	9.40E-01	5.93E-02	3.50E-01
20	QE202E100 / EE202E100	5.53E-09	1.31E-02	5.01E-01	4.78E-02	2.98E-01
25	QE252E100 / EE252E100	5.93E-09	1.39E-02	5.35E-01	4.87E-02	3.01E-01
32	QE322E100 / EE322E100	6.62E-09	1.53E-02	5.97E-01	5.10E-02	3.14E-01
40	QE402E100 / EE402E100	7.93E-09	1.77E-02	7.11E-01	5.41E-02	3.26E-01
50	QE502E100 / EE502E100	1.03E-08	2.23E-02	9.16E-01	5.95E-02	3.48E-01
20	QE201EEZY / EE201EEZY	5.76E-09	1.34E-02	5.22E-01	4.73E-02	2.98E-01
25	QE251EEZY / EE251EEZY	6.23E-09	1.45E-02	5.65E-01	4.92E-02	3.10E-01
32	QE321EEZY / EE321EEZY	6.85E-09	1.57E-02	6.18E-01	5.06E-02	3.15E-01
40	QE401EEZY / EE401EEZY	8.22E-09	1.82E-02	7.38E-01	5.36E-02	3.25E-01
50	QE501EEZY/ EE501EEZY	1.07E-08	2.29E-02	9.54E-01	5.94E-02	3.51E-01
20	QE202EEZY / EE202EEZY	5.68E-09	1.34E-02	5.15E-01	4.81E-02	3.01E-01
25	QE252EEZY / EE252EEZY	6.11E-09	1.43E-02	5.53E-01	4.98E-02	3.12E-01
32	QE322EEZY / EE322EEZY	6.68E-09	1.54E-02	6.04E-01	5.11E-02	3.17E-01
40	QE402EEZY / EE402EEZY	8.00E-09	1.79E-02	7.19E-01	5.42E-02	3.29E-01
50	QE502EEZY / EE502EEZY	1.04E-08	2.26E-02	9.33E-01	5.98E-02	3.52E-01

GREEN STAR INDICATORS		HT	LU	WSI	IR	PM
Strength (MPa)	Mix Code	CTUh	m^2	m^3	kBq U235 eq	kg PM2.5 eq
20	QE201EL21 / EE201EL21	5.71E-09	1.33E-02	5.19E-01	4.72E-02	3.03E-01
25	QE251EL21 / EE251EL21	6.22E-09	1.45E-02	5.65E-01	4.92E-02	3.15E-01
32	QE321EL21 / EE321EL21	6.99E-09	1.58E-02	6.32E-01	5.09E-02	3.22E-01
40	QE401EL21 / EE401EL21	8.38E-09	1.85E-02	7.54E-01	5.41E-02	3.35E-01
50	QE501EL21 / EE501EL21	1.08E-08	2.31E-02	9.64E-01	5.96E-02	3.57E-01
40	QE401E200 / EE401E200	8.14E-09	1.81E-02	7.33E-01	5.40E-02	3.34E-01
50	QE501E200 / EE501E200	1.16E-08	2.13E-02	1.04E+00	6.08E-02	3.65E-01
40	QE401EDUF / EE401EDUF	8.75E-09	1.93E-02	7.89E-01	5.57E-02	3.50E-01
50	QE501EDUF / EE501EDUF	9.64E-09	2.10E-02	8.68E-01	5.78E-02	3.60E-01
40	QE402PT1 / EE402PT1	1.03E-08	1.65E-02	9.29E-01	5.74E-02	3.47E-01
40	QE402PT2 / EE402PT2	1.03E-08	1.64E-02	9.29E-01	5.70E-02	3.47E-01
40	QE402PT3 / EE402PT3	1.03E-08	1.65E-02	9.31E-01	5.72E-02	3.52E-01
32	QE322LPN2 / EE322LPN2	8.90E-09	1.33E-02	8.10E-01	5.33E-02	3.20E-01
40	QE402LPN2 / EE402LPN2	9.81E-09	1.43E-02	8.92E-01	5.51E-02	3.26E-01
50	QE502LPN2 / EE502LPN2	1.33E-08	1.81E-02	1.21E+00	6.20E-02	3.51E-01
32	QE327ETOP / EE327ETOP	8.95E-09	1.60E-02	8.12E-01	5.49E-02	3.46E-01
32	QE327LSPR / EE327LSPR	9.60E-09	1.38E-02	8.76E-01	5.34E-02	3.27E-01
40	QE407LSPR / EE407LSPR	1.13E-08	1.56E-02	1.02E+00	5.72E-02	3.47E-01
32	QE322L652 / EE322L652	8.08E-09	1.23E-02	7.37E-01	5.10E-02	3.09E-01
40	QE402L652 / EE402L652	9.78E-09	1.41E-02	8.89E-01	5.43E-02	3.20E-01
65	QE651E200 / EE651E200	1.22E-08	2.22E-02	1.09E+00	6.21E-02	3.70E-01
80	QE801E200 / EE801E200	1.44E-08	2.58E-02	1.29E+00	6.78E-02	3.97E-01
65	QE651EDUF / EE651EDUF	1.22E-08	2.22E-02	1.10E+00	6.24E-02	3.81E-01
80	QE801EDUF / EE801EDUF	1.44E-08	2.58E-02	1.29E+00	6.82E-02	4.10E-01
40	QE401LMO1 / EE401LMO1	1.10E-08	1.51E-02	9.93E-01	5.75E-02	3.42E-01
40	QE402LMO1 / EE402LMO1	1.06E-08	1.46E-02	9.61E-01	5.63E-02	3.34E-01

Note: Some customer invoices may have a Z as the second charterer in their mix code (e.g. QZ202E). This indicates that the mix was sold as a carbon neutral ready-mix concrete (i.e. the residual Global Warming Potential was offset). To find the applicable mix code, please substitute the seconded charter in the mix code with an E (e.g. QE202E).

Other life cycle stages not included in this EPD

While the LCA study and EPD only consider the cradle to gate environmental impacts of Holcim's ready-mix concrete, practitioners using the EPD for the purpose of whole-of-life building studies or the functional comparison of different building products on a whole-of-life basis will consider concrete's other life cycle stages. Some of the environmental impacts of benefits associated with other life cycle stages not included in this EPD are described in the following sections.

Lifetime absorption of CO_2

Carbonation is a natural process whereby concrete absorbs carbon dioxide (CO_2) from the atmosphere through a chemical reaction between the CO_2 in the ambient air and hydration products within the concrete ($CaOH_2$). Ready-mix concrete can be subject to carbonation from the use stage onward (i.e. after construction and curing). From a life cycle impact accounting perspective, this process can also be referred to as 'reabsorption', since the CO_2 emitted during the cement manufacturing process can be partly offset by the lifetime absorption of CO_2, therefore reducing the net CO_2 emissions associated with concrete over its lifetime.

The carbonisation process is a commonly known process in building design and is typically taken into consideration by engineers when specifying special-class concrete.

The total amount of CO_2 absorption during the life cycle of concrete is subject to a range of factors and varies over time. The calculation has been standardised in the British and European Standard BS EN 16757:2017 *Sustainability of construction works – Environmental Product Declarations – Product Category Rules for concrete and concrete elements.* It is recommended that practitioners make use of this standard when conducting whole-of-life building studies and if the building materials include substantial amounts of concrete. Please note that CO_2 absorption has not been considered in this EPD and is not reflected in the EPD results tables.

End of life scenarios

BS EN 16757:2017 presents four end of life scenarios for concrete:

1. Disposal of concrete at a landfill site,
2. Reuse of recovered concrete elements in new construction works,
3. Use of concrete debris, e.g. In land restoration, or
4. Crushing/recycling of concrete:
    a. Crushed concrete substitutes primary material without further processing, or
    b. Substitution of natural aggregates in fresh concrete.

Scenarios 2, 3 and 4 can all result in benefits and loads outside the system boundary and thus should be considered in a whole-of-life building study or when comparing concrete products on a functional basis in line with BS EN 16757:2017.

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Programme-related information and verification

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 Programme Operator	EPD Australasia Limited 315a Hardy Street Nelson 7010, New Zealand Web: www.epd-australasia.com Email: info@epd-australasia.com Phone: 02 8005 8206	
EPD Produced by	Holcim (Australia) Pty Ltd Level 7, 799 Pacific Highway Chatswood NSW 2067, Australia Web: www.holcim.com.au Phone: +61 2 9412 6600	
EPD Process Certified by	Epsten Group Suite 2600, 101 Marietta St NW, Atlanta, Georgia 30303, USA Web: www.epstengroup.com	
EPD Registration Number	S-P-04658	
Valid From	2022-01-20	
Version	1.0	
Valid Until	2027-01-20	
Product category rules	PCR 2012:01 Construction Products and Construction Services, Version 2.3, 2018-11-15	
Product group classification	UN CPC 54	
Geographical Scope	Australia	
Reference Year for Data	2017 Plant Data, 2021 Mix/Materials Data	

CEN standard EN 15804:2012+a1:2013 served as the core PCR

Product category rules	PCR 2012:01 Construction Products and Construction Services, Version 2.3, 2018-11-15
PCR review was conducted by	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
Independent third-party verification of the declaration and data, according to ISO 14025:2006:	☒ EPD process certification ☐ EPD verification
EPD Process Certifed by	Epsten Group, Inc., Katherine McFeaters: Accredited by: A2LA, Certificate #3142.03
Procedure for follow-up of data during EPD validity involves third party verifier:	☐ Yes ☒ No

Programme-related information and verification:

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Contact your Holcim representative today for more information.

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