

ViroDecs[™] Special

Holcim Australia Ready-Mix Concrete

Queensland – Darling Downs – ECOPact Range

Environmental Product Declaration

In accordance with ISO 14025 and EN 15804+A2:2019

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.

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

Introduction

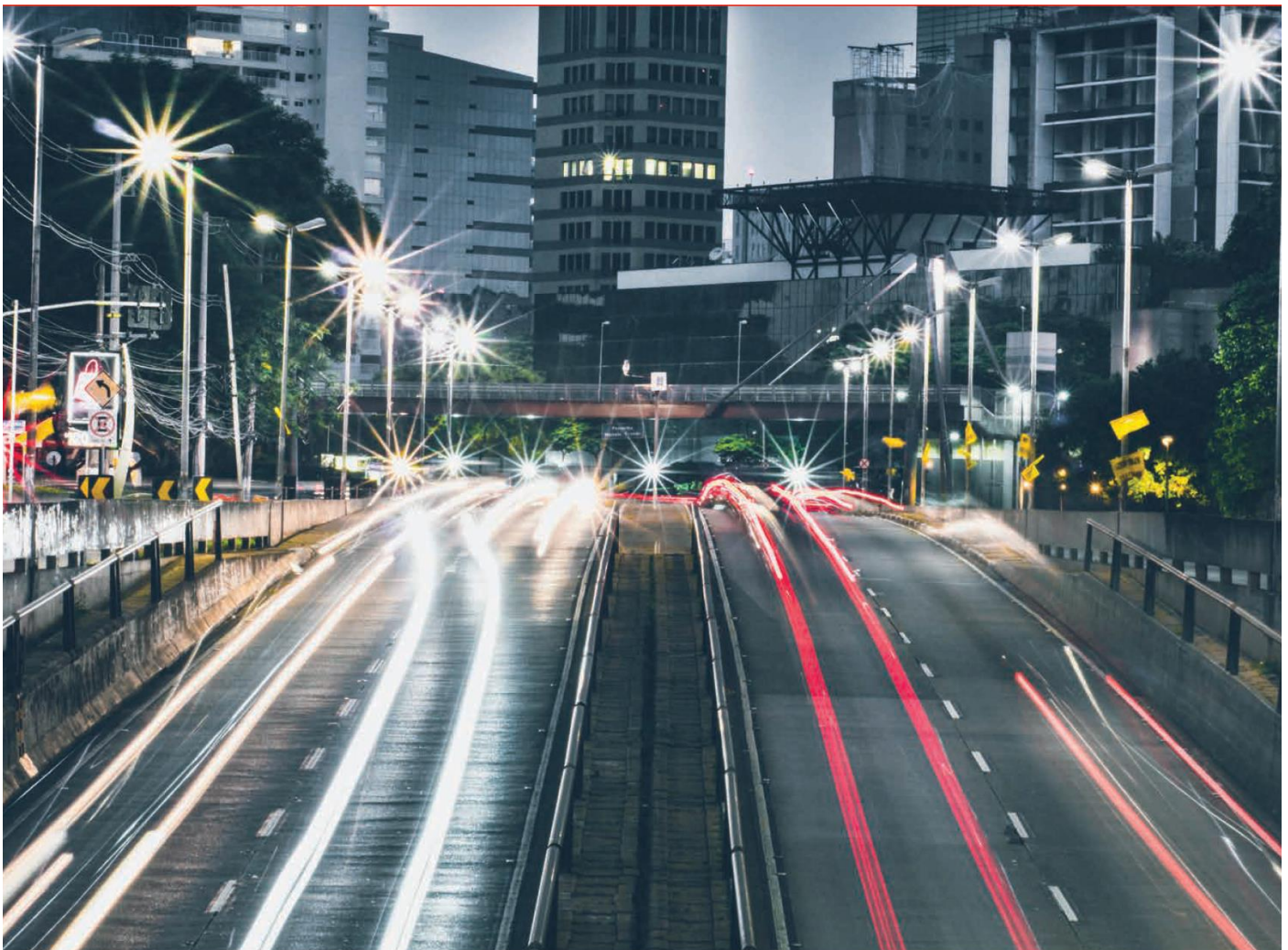
All around the world, the expectation for Governments and organisations to provide enhanced transparency and disclosure of environmental impacts, such as greenhouse gas (GHG) emissions, has been growing. This follows the landmark COP 21 Paris Agreement in 2015 in which all nations agreed to ambitiously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

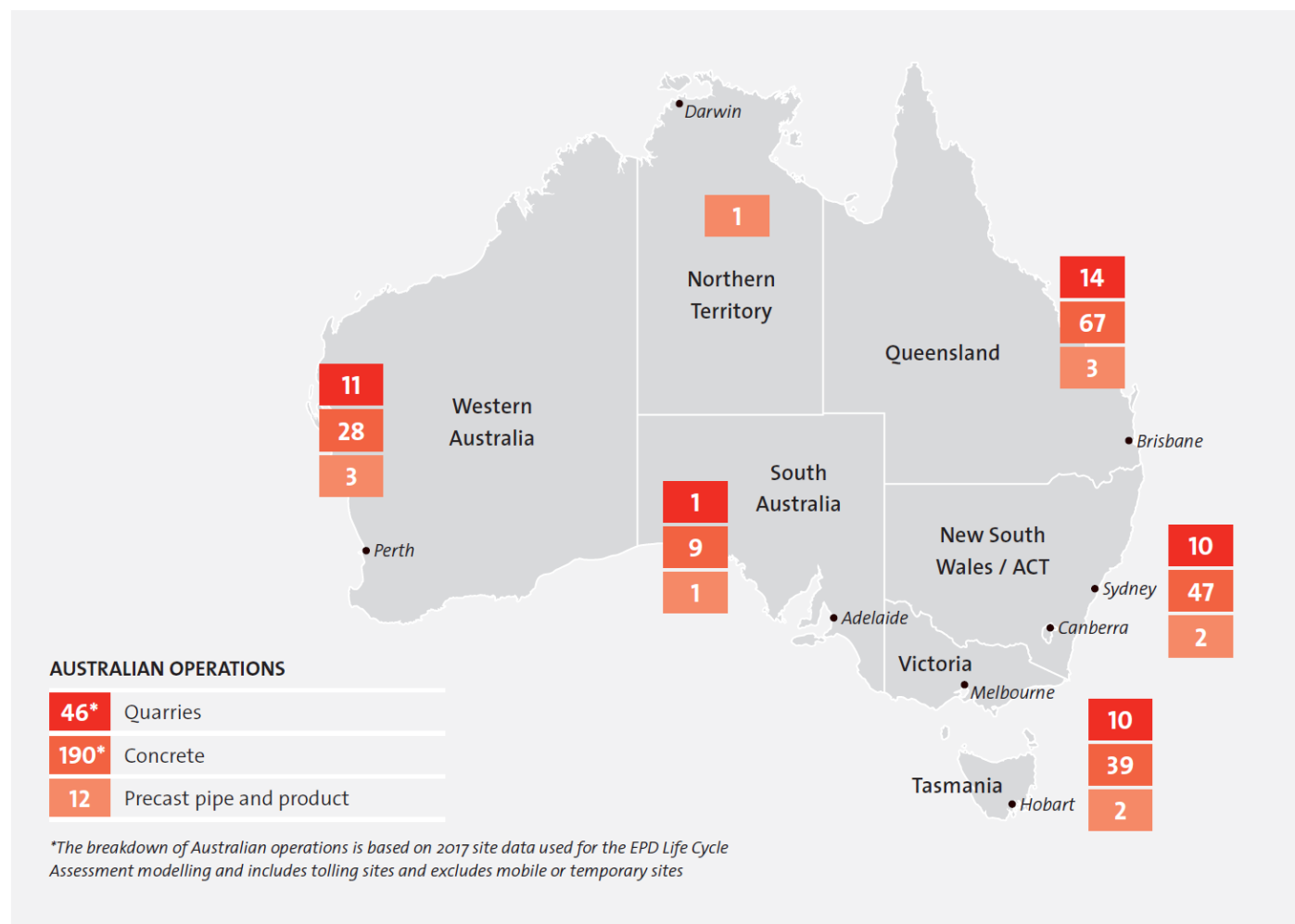
This clearly demonstrates both the essential need for construction materials now and in the future, as well as the necessity for the construction materials industry to be a leading part of the solution addressing climate change.

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 Australia is a leading supplier of construction materials in Australia, 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.

Sustainability is at the core of our strategy, with our industry's first 2050 net-zero targets, endorsed by the Science Based Targets initiative (SBTi).

Globally, Holcim is 70,000 people around the world who are passionate about building progress for people and the planet through four business segments: Cement, Ready-Mix Concrete, Aggregates and Solutions & Products.

Holcim builds progress for people and the planet. As a global leader in innovative and sustainable building solutions, Holcim is enabling greener cities, smarter infrastructure and improving living standards around the world. With sustainability at the core of its strategy Holcim is becoming a net zero company, with its people and communities at the heart of its success. The company is driving circular construction as a world leader in recycling to build more with less.

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

ViroDecs™ Special at a glance

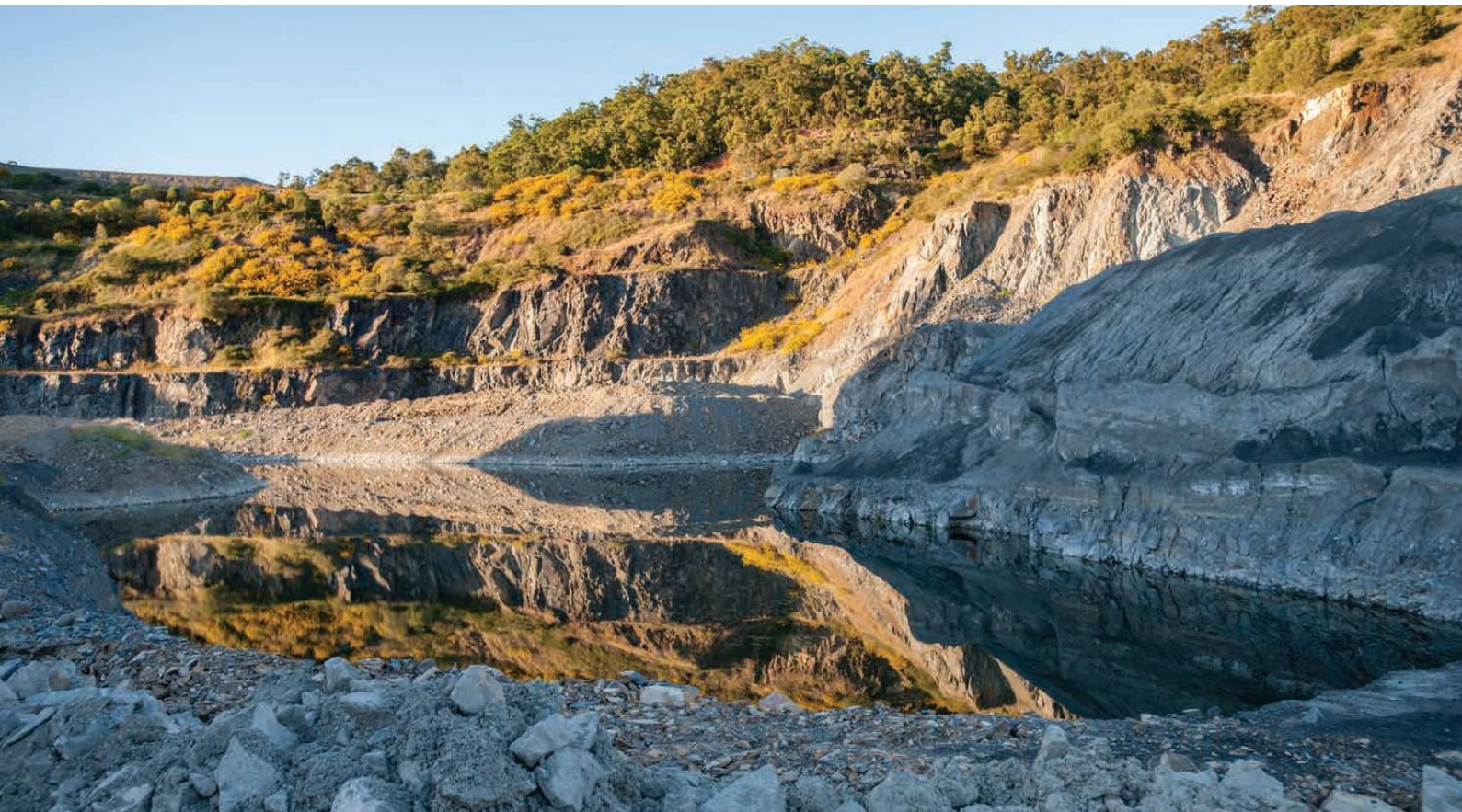
The Holcim ViroDecs™ Special provides project-specific, on-demand Environmental Product Declarations (EPDs) to Holcim's customers. This capability represents a significant step in Holcim's sustainability journey and embodies our multi-disciplinary approach to embedding sustainability into our organisation 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 now specify concrete sustainability performance in terms of CO₂-e, with the confidence that our claims are backed by our third-party verified EPD Process Certification.

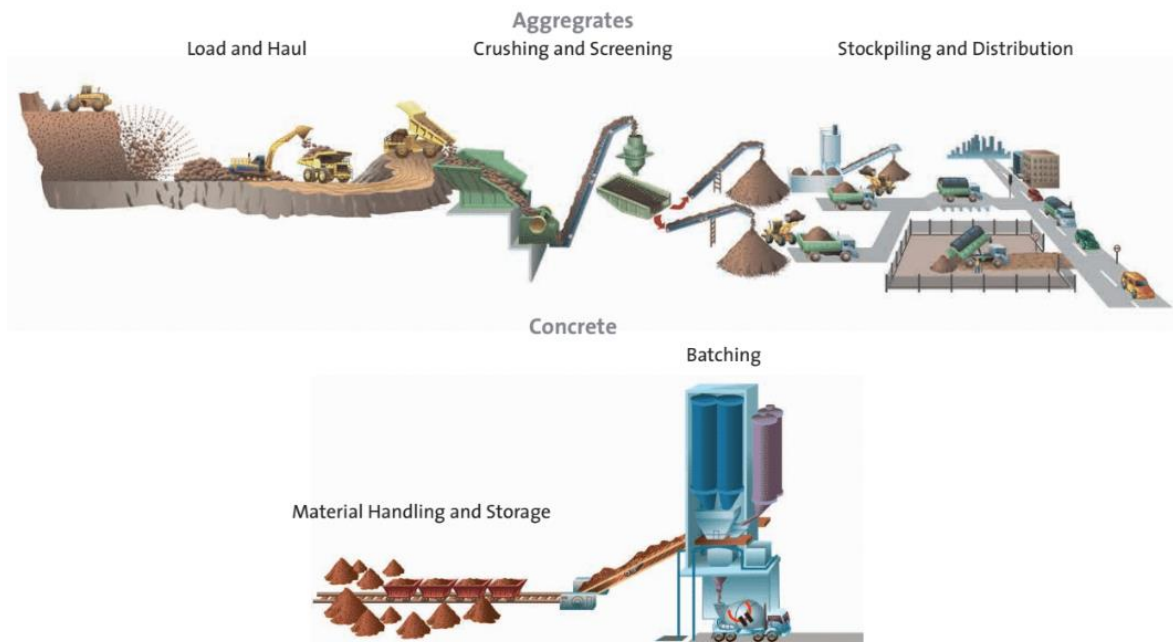
Holcim ViroDecs™ Special is backed by an EPD Process Certification. It's not only a first for concrete but a first for any product in Australia. Our EPD Process Certification is a stamp of approval to produce compliant EPDs in-house, opening up significant capability and flexibility in producing and 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 Queensland – Darling Downs – ECOPact Range with production occurring at Holcim Darling Downs 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 m³ 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 2022 calendar year production data.

Databases and LCA Software Used

SimaPro® LCA software (v 9.1) 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) (2018)
2. Ecoinvent 3.6 (2019)
3. Global Cement and Concrete (GCCA) EPD Tool Project Database version 3.1 (International Version) (2021); and
4. Product specific EPDs for pigments and fibres.

The environmental impacts modelled from the 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 m² 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

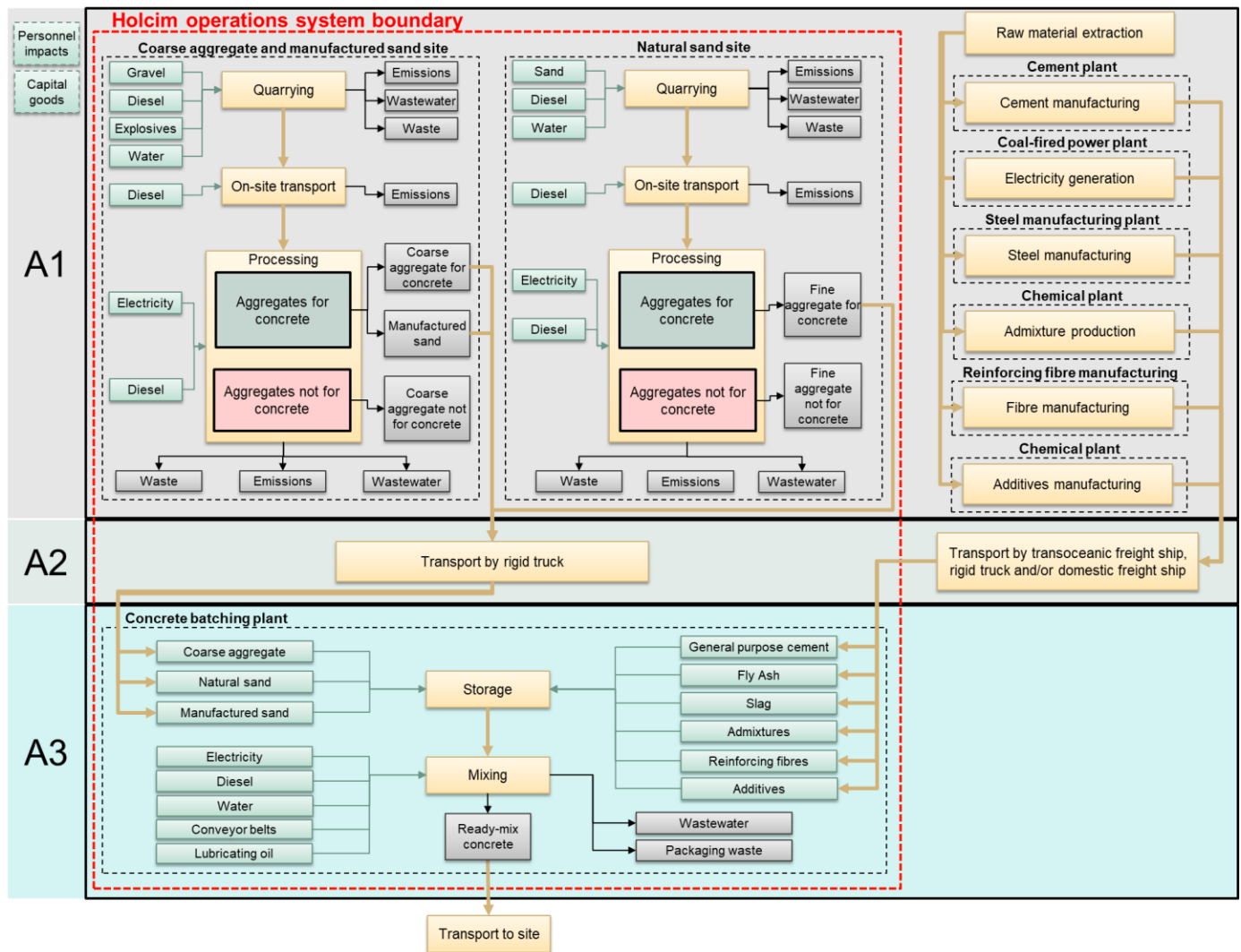
Data quality for the foreground data was assessed in terms of geographic and temporal representativeness. All data sources were scored medium or higher.

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 2019:14 version 1.11.

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 (2019:14 Construction Production version 1.11).

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 Queensland – Darling Downs – 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	QE201E	N20/10/80 ECOPact Concrete	32	QE322LRC	N32/20/80 Rapidcrete ECOPact Concrete
20	QE201E100	N20/10/100 ECOPact Concrete	32	QE322LRC1	N32/20/100 Rapidcrete ECOPact Concrete
25	QE251E	N25/10/80 ECOPact Concrete	20	QE201L	N20/10/80 ECOPact Concrete
25	QE251E100	N25/10/100 ECOPact Concrete	20	QE201L100	N20/10/100 ECOPact Concrete
32	QE321E	N32/10/80 ECOPact Concrete	25	QE251L	N25/10/80 ECOPact Concrete
32	QE321E100	N32/10/100 ECOPact Concrete	25	QE251L100	N25/10/100 ECOPact Concrete
40	QE401E	N40/10/80 ECOPact Concrete	32	QE321L	N32/10/80 ECOPact Concrete
40	QE401E100	N40/10/100 ECOPact Concrete	32	QE321L100	N32/10/100 ECOPact Concrete
20	QE202E	N20/20/80 ECOPact Concrete	40	QE401L	N40/10/80 ECOPact Concrete
20	QE202E100	N20/20/100 ECOPact Concrete	40	QE401L100	N40/10/100 ECOPact Concrete
25	QE252E	N25/20/80 ECOPact Concrete	20	QE202L	N20/20/80 ECOPact Concrete
25	QE252E100	N25/20/100 ECOPact Concrete	20	QE202L100	N20/20/100 ECOPact Concrete
32	QE322E	N32/20/80 ECOPact Concrete	25	QE252L	N25/20/80 ECOPact Concrete
32	QE322E100	N32/20/100 ECOPact Concrete	25	QE252L100	N25/20/100 ECOPact Concrete
40	QE402E	N40/20/80 ECOPact Concrete	32	QE322L	N32/20/80 ECOPact Concrete
40	QE402E100	N40/20/100 ECOPact Concrete	32	QE322L100	N32/20/100 ECOPact Concrete
25	QE251EL2	N25/20/80 2in' Line ECOPact Concrete	40	QE402L	N40/20/80 ECOPact Concrete
25	QE251EL21	N25/20/100 2in' Line ECOPact Concrete	40	QE402L100	N40/20/100 ECOPact Concrete
32	QE321EL2	N32/20/80 2in' Line ECOPact Concrete	25	QE251LL2	N25/20/80 2in' Line ECOPact Concrete
32	QE321EL21	N32/20/100 2in' Line ECOPact Concrete	25	QE251LL21	N25/20/100 2in' Line ECOPact Concrete
40	QE401EL2	N40/20/80 2in' Line ECOPact Concrete	32	QE321LL2	N32/20/80 2in' Line ECOPact Concrete
40	QE401EL21	N40/20/100 2in' Line ECOPact Concrete	32	QE321LL21	N32/20/100 2in' Line ECOPact Concrete
20	QE202LRC	N20/20/80 Rapidcrete ECOPact Concrete	40	QE401LL2	N40/20/80 2in' Line ECOPact Concrete
20	QE202LRC1	N20/20/100 Rapidcrete ECOPact Concrete	40	QE401LL21	N40/20/100 2in' Line ECOPact Concrete
25	QE252LRC	N25/20/80 Rapidcrete ECOPact Concrete			
25	QE252LRC1	N25/20/100 Rapidcrete ECOPact Concrete			

Note: Some customer invoices may have a Z as the second character 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 second character 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.

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

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

- 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.

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 2019:14 Construction Products version 1.11 (co-produced goods, multi-output allocation).

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		
Total global warming potential	GWPT	kg CO ₂ equivalents (GWP100)
Global warming potential (fossil)	GWPF	kg CO ₂ equivalents (GWP100)
Global warming potential (biogenic)	GWPB	kg CO ₂ equivalents (GWP100)
Global warming potential (land use/ land transformation)	GWPL	kg CO ₂ equivalents (GWP100)
Ozone depletion potential	ODP	kg CFC 11 equivalents
Acidification potential	AP	mol H ⁺ eq.
Eutrophication – aquatic freshwater	EP - freshwater	kg PO ₄ ³⁻ equivalents
Eutrophication – aquatic freshwater	EP - freshwater	kg P equivalent
Eutrophication – aquatic marine	EP - marine	kg N equivalent
Eutrophication – terrestrial	EP – terrestrial	mol N equivalent
Photochemical ozone creation potential	POCP	kg NMVOC equivalents
Abiotic depletion potential (elements)	ADPE	kg Sb equivalents
Abiotic depletion potential (fossil fuels)	ADPF	MJ net calorific value
Water Depletion Potential	WDP	m ³ equivalent deprived
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

Impact Category	Abbreviation	Measurement Unit
Waste categories and Output flows		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed/stored	RWD	kg
Components for reuse	CFR	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MFEE	kg
Exported energy	EE - e	MJ per energy carrier
Exported energy, thermal	EE - t	MJ per energy carrier
Additional environmental impacts		
Particulate matter	PM	disease incidence
Ionising radiation - human health	IRP	kBq U-235 eq
Eco-toxicity (freshwater)	ETP-fw	CTUe
Human toxicity potential - cancer effects	HTP-c	CTUh
Human toxicity potential - non cancer effects	HTP-nc	CTUh
Soil quality	SQP	dimensionless

Queensland – Darling Downs – ECOPact Range

Primary indicators - 1m³ of ViroDecs™ ready-mix concrete

PRIMARY ENVIRONMENTAL INDICATORS		GWPT	GWPF	GWPB	GWPL	ODP	AP	EP - freshwater	EP - freshwater2	EP - marine	EP – terrestrial	POCP	ADPE	ADPF	WDP
Strength (MPa)	Mix Code	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CFC 11 eq.	mol H+ eq.	kg PO43- eq.	kg P eq.	kg N eq.	mol N eq.	kg NMVOC eq.	kg Sb eq.	MJ	m3
20	QE201E	154	154	0.10	4.60E-04	4.11E-06	8.14E-01	1.19E-01	1.82E-03	2.33E-01	2.61E+00	6.76E-01	9.44E-05	6.78E+02	7.92E+02
20	QE201E100	157	157	0.10	4.67E-04	4.15E-06	8.26E-01	1.21E-01	1.85E-03	2.37E-01	2.64E+00	6.86E-01	9.54E-05	6.88E+02	8.05E+02
25	QE251E	169	169	0.11	5.03E-04	4.36E-06	8.83E-01	1.30E-01	1.98E-03	2.52E-01	2.82E+00	7.30E-01	1.01E-04	7.36E+02	8.65E+02
25	QE251E100	172	172	0.11	5.10E-04	4.40E-06	8.95E-01	1.32E-01	2.00E-03	2.55E-01	2.85E+00	7.39E-01	1.02E-04	7.46E+02	8.78E+02
32	QE321E	191	191	0.12	5.65E-04	4.78E-06	9.87E-01	1.46E-01	2.20E-03	2.80E-01	3.13E+00	8.11E-01	1.10E-04	8.25E+02	9.73E+02
32	QE321E100	196	196	0.13	5.80E-04	4.85E-06	1.01E+00	1.49E-01	2.25E-03	2.86E-01	3.20E+00	8.28E-01	1.12E-04	8.43E+02	9.97E+02
40	QE401E	226	226	0.15	6.67E-04	5.38E-06	1.15E+00	1.71E-01	2.57E-03	3.24E-01	3.63E+00	9.37E-01	1.25E-04	9.62E+02	1.14E+03
40	QE401E100	232	232	0.15	6.82E-04	5.46E-06	1.17E+00	1.74E-01	2.63E-03	3.30E-01	3.70E+00	9.56E-01	1.27E-04	9.83E+02	1.17E+03
20	QE202E	155	154	0.10	4.49E-04	4.04E-06	8.03E-01	1.18E-01	1.81E-03	2.33E-01	2.60E+00	6.73E-01	9.39E-05	6.67E+02	7.82E+02
20	QE202E100	157	157	0.10	4.57E-04	4.08E-06	8.15E-01	1.20E-01	1.83E-03	2.36E-01	2.64E+00	6.82E-01	9.49E-05	6.77E+02	7.95E+02
25	QE252E	166	166	0.10	4.81E-04	4.23E-06	8.56E-01	1.26E-01	1.93E-03	2.47E-01	2.76E+00	7.14E-01	9.87E-05	7.12E+02	8.38E+02
25	QE252E100	171	171	0.11	4.96E-04	4.31E-06	8.77E-01	1.29E-01	1.97E-03	2.52E-01	2.82E+00	7.30E-01	1.00E-04	7.31E+02	8.61E+02
32	QE322E	190	190	0.12	5.50E-04	4.67E-06	9.67E-01	1.43E-01	2.17E-03	2.77E-01	3.10E+00	8.02E-01	1.09E-04	8.06E+02	9.53E+02
32	QE322E100	195	195	0.13	5.65E-04	4.76E-06	9.92E-01	1.47E-01	2.23E-03	2.84E-01	3.17E+00	8.20E-01	1.11E-04	8.27E+02	9.80E+02
40	QE402E	224	224	0.15	6.46E-04	5.26E-06	1.13E+00	1.67E-01	2.53E-03	3.20E-01	3.58E+00	9.25E-01	1.23E-04	9.41E+02	1.12E+03
40	QE402E100	230	230	0.15	6.63E-04	5.35E-06	1.15E+00	1.71E-01	2.59E-03	3.26E-01	3.65E+00	9.43E-01	1.25E-04	9.62E+02	1.15E+03
25	QE251EL2	174	174	0.11	5.14E-04	4.40E-06	9.03E-01	1.33E-01	2.01E-03	2.58E-01	2.89E+00	7.47E-01	1.01E-04	7.51E+02	8.81E+02
25	QE251EL21	177	177	0.12	5.25E-04	4.49E-06	9.21E-01	1.36E-01	2.05E-03	2.63E-01	2.94E+00	7.61E-01	1.03E-04	7.66E+02	8.97E+02
32	QE321EL2	198	198	0.13	5.81E-04	4.84E-06	1.01E+00	1.50E-01	2.25E-03	2.88E-01	3.23E+00	8.34E-01	1.12E-04	8.45E+02	9.97E+02
32	QE321EL21	200	200	0.13	5.87E-04	4.87E-06	1.02E+00	1.51E-01	2.27E-03	2.91E-01	3.25E+00	8.41E-01	1.12E-04	8.52E+02	1.01E+03
40	QE401EL2	234	234	0.16	6.86E-04	5.47E-06	1.18E+00	1.76E-01	2.64E-03	3.33E-01	3.73E+00	9.64E-01	1.27E-04	9.89E+02	1.18E+03
40	QE401EL21	238	238	0.16	7.01E-04	5.55E-06	1.20E+00	1.79E-01	2.69E-03	3.39E-01	3.79E+00	9.80E-01	1.29E-04	1.01E+03	1.20E+03
20	QE202LRC	203	203	0.15	8.61E-04	3.67E-06	8.36E-01	1.79E-01	2.02E-03	2.69E-01	3.01E+00	7.65E-01	1.06E-04	7.21E+02	8.50E+02
20	QE202LRC1	205	205	0.16	8.76E-04	3.69E-06	8.45E-01	1.82E-01	2.04E-03	2.72E-01	3.04E+00	7.73E-01	1.07E-04	7.29E+02	8.61E+02
25	QE252LRC	224	224	0.17	9.53E-04	3.88E-06	9.10E-01	1.97E-01	2.20E-03	2.92E-01	3.27E+00	8.31E-01	1.14E-04	7.87E+02	9.33E+02
25	QE252LRC1	226	226	0.17	9.70E-04	3.94E-06	9.21E-01	2.00E-01	2.23E-03	2.96E-01	3.31E+00	8.41E-01	1.15E-04	7.97E+02	9.44E+02
32	QE322LRC	254	253	0.20	1.09E-03	4.22E-06	1.02E+00	2.23E-01	2.46E-03	3.26E-01	3.65E+00	9.26E-01	1.25E-04	8.82E+02	1.05E+03
32	QE322LRC1	256	256	0.20	1.10E-03	4.24E-06	1.03E+00	2.26E-01	2.49E-03	3.29E-01	3.68E+00	9.34E-01	1.26E-04	8.90E+02	1.06E+03
20	QE201L	211	211	0.11	9.38E-04	3.72E-06	8.69E-01	1.49E+00	2.16E-03	2.78E-01	3.12E+00	7.93E-01	1.07E-04	6.87E+02	8.75E+02

PRIMARY ENVIRONMENTAL INDICATORS		GWPT	GWPF	GWPB	GWPL	ODP	AP	EP - freshwater	EP - freshwater2	EP - marine	EP – terrestrial	POCP	ADPE	ADPF	WDP
Strength (MPa)	Mix Code	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CO2 eq.	kg CFC 11 eq.	mol H+ eq.	kg PO43- eq.	kg P eq.	kg N eq.	mol N eq.	kg NMVOC eq.	kg Sb eq.	MJ	m3
20	QE201L100	214	214	0.11	9.52E-04	3.75E-06	8.81E-01	1.51E+00	2.19E-03	2.82E-01	3.17E+00	8.03E-01	1.08E-04	6.96E+02	8.89E+02
25	QE251L	232	231	0.12	1.03E-03	3.97E-06	9.46E-01	1.65E+00	2.36E-03	3.03E-01	3.40E+00	8.61E-01	1.16E-04	7.47E+02	9.57E+02
25	QE251L100	234	234	0.12	1.05E-03	4.00E-06	9.55E-01	1.67E+00	2.39E-03	3.05E-01	3.43E+00	8.69E-01	1.16E-04	7.55E+02	9.68E+02
32	QE321L	264	264	0.14	1.18E-03	4.32E-06	1.06E+00	1.90E+00	2.66E-03	3.39E-01	3.80E+00	9.63E-01	1.28E-04	8.40E+02	1.09E+03
32	QE321L100	271	271	0.14	1.21E-03	4.38E-06	1.09E+00	1.96E+00	2.73E-03	3.47E-01	3.89E+00	9.85E-01	1.30E-04	8.60E+02	1.12E+03
40	QE401L	315	314	0.17	1.48E-03	4.85E-06	1.24E+00	2.43E+00	3.13E-03	3.95E-01	4.44E+00	1.12E+00	1.47E-04	9.85E+02	1.29E+03
40	QE401L100	322	322	0.17	1.57E-03	4.92E-06	1.27E+00	2.60E+00	3.20E-03	4.03E-01	4.53E+00	1.14E+00	1.49E-04	1.01E+03	1.32E+03
20	QE202L	205	205	0.11	9.08E-04	3.68E-06	8.48E-01	1.43E+00	2.12E-03	2.72E-01	3.05E+00	7.74E-01	1.06E-04	6.73E+02	8.57E+02
20	QE202L100	208	208	0.11	9.25E-04	3.71E-06	8.57E-01	1.46E+00	2.14E-03	2.74E-01	3.08E+00	7.81E-01	1.07E-04	6.80E+02	8.68E+02
25	QE252L	223	223	0.12	9.98E-04	3.91E-06	9.15E-01	1.59E+00	2.29E-03	2.93E-01	3.28E+00	8.33E-01	1.13E-04	7.26E+02	9.28E+02
25	QE252L100	226	226	0.12	1.01E-03	3.94E-06	9.27E-01	1.61E+00	2.32E-03	2.96E-01	3.32E+00	8.43E-01	1.14E-04	7.36E+02	9.42E+02
32	QE322L	242	242	0.13	1.08E-03	4.11E-06	9.83E-01	1.73E+00	2.47E-03	3.14E-01	3.52E+00	8.93E-01	1.20E-04	7.80E+02	1.00E+03
32	QE322L100	261	261	0.14	1.17E-03	4.30E-06	1.05E+00	1.88E+00	2.64E-03	3.34E-01	3.76E+00	9.51E-01	1.27E-04	8.33E+02	1.08E+03
40	QE402L	305	305	0.16	1.37E-03	4.78E-06	1.21E+00	2.22E+00	3.06E-03	3.84E-01	4.31E+00	1.09E+00	1.44E-04	9.59E+02	1.25E+03
40	QE402L100	312	312	0.17	1.45E-03	4.84E-06	1.23E+00	2.36E+00	3.12E-03	3.92E-01	4.40E+00	1.11E+00	1.46E-04	9.81E+02	1.28E+03
25	QE251LL2	239	239	0.13	1.07E-03	4.03E-06	9.74E-01	1.71E+00	2.42E-03	3.12E-01	3.50E+00	8.87E-01	1.18E-04	7.67E+02	9.84E+02
25	QE251LL21	243	243	0.13	1.08E-03	4.06E-06	9.86E-01	1.73E+00	2.45E-03	3.16E-01	3.54E+00	8.97E-01	1.19E-04	7.76E+02	9.98E+02
32	QE321LL2	274	274	0.15	1.22E-03	4.39E-06	1.10E+00	1.98E+00	2.74E-03	3.50E-01	3.93E+00	9.95E-01	1.31E-04	8.64E+02	1.12E+03
32	QE321LL21	272	271	0.15	1.25E-03	4.37E-06	1.09E+00	2.03E+00	2.72E-03	3.47E-01	3.90E+00	9.86E-01	1.30E-04	8.59E+02	1.11E+03
40	QE401LL2	325	325	0.18	1.62E-03	4.94E-06	1.28E+00	2.69E+00	3.22E-03	4.07E-01	4.58E+00	1.16E+00	1.50E-04	1.02E+03	1.32E+03
40	QE401LL21	333	333	0.18	1.72E-03	5.00E-06	1.31E+00	2.87E+00	3.29E-03	4.15E-01	4.67E+00	1.18E+00	1.53E-04	1.04E+03	1.35E+03

Resource use parameters - 1m³ of ViroDecs™ ready-mix concrete

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	QE201E	1.95E+01	3.95E-04	1.95E+01	6.64E+02	1.87E+02	8.51E+02	1.34E+02	9.59E-06	0.00E+00	1.02E-01
20	QE201E100	1.98E+01	4.04E-04	1.98E+01	6.74E+02	1.85E+02	8.59E+02	1.36E+02	9.79E-06	0.00E+00	1.04E-01
25	QE251E	2.13E+01	4.42E-04	2.13E+01	7.20E+02	1.86E+02	9.06E+02	1.49E+02	1.07E-05	0.00E+00	1.10E-01
25	QE251E100	2.16E+01	4.50E-04	2.16E+01	7.30E+02	1.85E+02	9.14E+02	1.51E+02	1.09E-05	0.00E+00	1.12E-01
32	QE321E	2.39E+01	5.07E-04	2.39E+01	8.05E+02	1.91E+02	9.96E+02	1.71E+02	1.20E-05	0.00E+00	1.22E-01
32	QE321E100	2.45E+01	5.24E-04	2.45E+01	8.22E+02	1.89E+02	1.01E+03	1.76E+02	1.23E-05	0.00E+00	1.25E-01
40	QE401E	2.81E+01	6.18E-04	2.81E+01	9.36E+02	1.89E+02	1.13E+03	2.07E+02	1.46E-05	0.00E+00	1.41E-01
40	QE401E100	2.87E+01	6.34E-04	2.87E+01	9.56E+02	1.88E+02	1.14E+03	2.13E+02	1.49E-05	0.00E+00	1.44E-01
20	QE202E	1.93E+01	3.82E-04	1.93E+01	6.55E+02	1.85E+02	8.40E+02	1.24E+02	9.28E-06	0.00E+00	1.02E-01
20	QE202E100	1.96E+01	3.91E-04	1.96E+01	6.64E+02	1.84E+02	8.48E+02	1.26E+02	9.48E-06	0.00E+00	1.03E-01
25	QE252E	2.06E+01	4.17E-04	2.06E+01	6.97E+02	1.85E+02	8.82E+02	1.34E+02	1.01E-05	0.00E+00	1.08E-01
25	QE252E100	2.12E+01	4.33E-04	2.12E+01	7.15E+02	1.83E+02	8.98E+02	1.41E+02	1.05E-05	0.00E+00	1.10E-01
32	QE322E	2.34E+01	4.89E-04	2.34E+01	7.87E+02	1.89E+02	9.77E+02	1.59E+02	1.15E-05	0.00E+00	1.21E-01
32	QE322E100	2.41E+01	5.06E-04	2.41E+01	8.08E+02	1.87E+02	9.95E+02	1.64E+02	1.19E-05	0.00E+00	1.24E-01
40	QE402E	2.76E+01	5.93E-04	2.76E+01	9.16E+02	1.87E+02	1.10E+03	1.92E+02	1.40E-05	0.00E+00	1.40E-01
40	QE402E100	2.82E+01	6.11E-04	2.82E+01	9.36E+02	1.85E+02	1.12E+03	1.98E+02	1.44E-05	0.00E+00	1.42E-01
25	QE251EL2	2.16E+01	4.56E-04	2.16E+01	7.33E+02	1.93E+02	9.26E+02	1.53E+02	1.10E-05	0.00E+00	1.12E-01
25	QE251EL21	2.20E+01	4.66E-04	2.20E+01	7.48E+02	1.97E+02	9.45E+02	1.57E+02	1.13E-05	0.00E+00	1.14E-01
32	QE321EL2	2.45E+01	5.27E-04	2.45E+01	8.24E+02	1.97E+02	1.02E+03	1.77E+02	1.24E-05	0.00E+00	1.25E-01
32	QE321EL21	2.47E+01	5.34E-04	2.47E+01	8.31E+02	1.96E+02	1.03E+03	1.79E+02	1.26E-05	0.00E+00	1.26E-01
40	QE401EL2	2.88E+01	6.41E-04	2.88E+01	9.61E+02	1.95E+02	1.16E+03	2.15E+02	1.51E-05	0.00E+00	1.45E-01
40	QE401EL21	2.94E+01	6.57E-04	2.94E+01	9.79E+02	1.93E+02	1.17E+03	2.21E+02	1.55E-05	0.00E+00	1.47E-01
20	QE202LRC	2.13E+01	1.02E-03	2.13E+01	6.62E+02	2.27E+02	8.89E+02	8.84E+01	1.21E-05	0.00E+00	1.20E-01
20	QE202LRC1	2.16E+01	1.04E-03	2.16E+01	6.69E+02	2.26E+02	8.95E+02	9.08E+01	1.24E-05	0.00E+00	1.21E-01
25	QE252LRC	2.34E+01	1.15E-03	2.34E+01	7.20E+02	2.31E+02	9.51E+02	9.89E+01	1.36E-05	0.00E+00	1.30E-01
25	QE252LRC1	2.36E+01	1.17E-03	2.36E+01	7.29E+02	2.37E+02	9.65E+02	1.02E+02	1.38E-05	0.00E+00	1.32E-01
32	QE322LRC	2.63E+01	1.32E-03	2.63E+01	8.03E+02	2.43E+02	1.05E+03	1.14E+02	1.55E-05	0.00E+00	1.45E-01
32	QE322LRC1	2.66E+01	1.34E-03	2.66E+01	8.10E+02	2.42E+02	1.05E+03	1.17E+02	1.57E-05	0.00E+00	1.46E-01
20	QE201L	2.18E+01	1.65E-03	2.19E+01	6.79E+02	1.79E+02	8.57E+02	7.28E+01	8.54E-06	0.00E+00	1.23E-01
20	QE201L100	2.22E+01	1.68E-03	2.22E+01	6.88E+02	1.77E+02	8.65E+02	7.38E+01	8.69E-06	0.00E+00	1.24E-01
25	QE251L	2.39E+01	1.83E-03	2.39E+01	7.38E+02	1.83E+02	9.21E+02	8.08E+01	9.45E-06	0.00E+00	1.33E-01

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
25	QE251L100	2.42E+01	1.86E-03	2.42E+01	7.45E+02	1.81E+02	9.26E+02	8.28E+01	9.60E-06	0.00E+00	1.35E-01
32	QE321L	2.71E+01	2.13E-03	2.71E+01	8.27E+02	1.81E+02	1.01E+03	9.40E+01	1.07E-05	0.00E+00	1.49E-01
32	QE321L100	2.78E+01	2.19E-03	2.78E+01	8.47E+02	1.79E+02	1.03E+03	9.60E+01	1.11E-05	0.00E+00	1.53E-01
40	QE401L	3.21E+01	2.73E-03	3.21E+01	9.67E+02	1.79E+02	1.15E+03	1.13E+02	1.34E-05	0.00E+00	1.74E-01
40	QE401L100	3.28E+01	2.93E-03	3.28E+01	9.87E+02	1.79E+02	1.17E+03	1.15E+02	1.40E-05	0.00E+00	1.78E-01
20	QE202L	2.14E+01	1.59E-03	2.14E+01	6.66E+02	1.69E+02	8.35E+02	6.97E+01	8.24E-06	0.00E+00	1.20E-01
20	QE202L100	2.17E+01	1.63E-03	2.17E+01	6.73E+02	1.67E+02	8.40E+02	7.17E+01	8.41E-06	0.00E+00	1.21E-01
25	QE252L	2.32E+01	1.77E-03	2.32E+01	7.18E+02	1.74E+02	8.92E+02	7.88E+01	9.10E-06	0.00E+00	1.29E-01
25	QE252L100	2.35E+01	1.79E-03	2.35E+01	7.27E+02	1.72E+02	8.99E+02	7.98E+01	9.25E-06	0.00E+00	1.31E-01
32	QE322L	2.51E+01	1.93E-03	2.51E+01	7.70E+02	1.72E+02	9.43E+02	8.59E+01	9.76E-06	0.00E+00	1.39E-01
32	QE322L100	2.69E+01	2.10E-03	2.69E+01	8.22E+02	1.70E+02	9.91E+02	9.30E+01	1.06E-05	0.00E+00	1.48E-01
40	QE402L	3.13E+01	2.49E-03	3.13E+01	9.43E+02	1.68E+02	1.11E+03	1.09E+02	1.26E-05	0.00E+00	1.70E-01
40	QE402L100	3.20E+01	2.65E-03	3.20E+01	9.63E+02	1.67E+02	1.13E+03	1.11E+02	1.31E-05	0.00E+00	1.73E-01
25	QE251LL2	2.45E+01	1.90E-03	2.45E+01	7.57E+02	1.92E+02	9.49E+02	8.39E+01	9.61E-06	0.00E+00	1.37E-01
25	QE251LL21	2.49E+01	1.93E-03	2.49E+01	7.66E+02	1.91E+02	9.57E+02	8.49E+01	9.76E-06	0.00E+00	1.39E-01
32	QE321LL2	2.79E+01	2.21E-03	2.79E+01	8.51E+02	1.90E+02	1.04E+03	9.70E+01	1.11E-05	0.00E+00	1.54E-01
32	QE321LL21	2.77E+01	2.27E-03	2.77E+01	8.45E+02	1.88E+02	1.03E+03	1.00E+02	1.15E-05	0.00E+00	1.53E-01
40	QE401LL2	3.30E+01	3.04E-03	3.30E+01	9.93E+02	1.92E+02	1.18E+03	1.17E+02	1.43E-05	0.00E+00	1.79E-01
40	QE401LL21	3.37E+01	3.25E-03	3.37E+01	1.01E+03	1.92E+02	1.20E+03	1.19E+02	1.50E-05	0.00E+00	1.83E-01

Waste categories and output flows - 1m³ of ViroDecs™ ready-mix concrete

WASTE CATEGORIES AND OUTPUT FLOWS		HWD	NHWD	RWD	CFR	MFR	MFEE	EE - e	EE - t
Strength (MPa)	Mix Code	kg	kg	kg	kg	kg	kg	MJ	MJ
20	QE201E	2.75E+01	6.21E+00	1.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE201E100	2.80E+01	6.29E+00	1.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251E	3.07E+01	6.67E+00	1.34E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251E100	3.12E+01	6.74E+00	1.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321E	3.51E+01	7.37E+00	1.54E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321E100	3.62E+01	7.51E+00	1.59E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401E	4.27E+01	8.45E+00	1.87E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401E100	4.38E+01	8.60E+00	1.92E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202E	2.66E+01	6.13E+00	1.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202E100	2.71E+01	6.21E+00	1.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252E	2.90E+01	6.48E+00	1.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252E100	3.01E+01	6.62E+00	1.31E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322E	3.38E+01	7.24E+00	1.48E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322E100	3.49E+01	7.40E+00	1.53E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402E	4.10E+01	8.29E+00	1.80E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402E100	4.22E+01	8.45E+00	1.85E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251EL2	3.17E+01	6.73E+00	1.38E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251EL21	3.24E+01	6.85E+00	1.41E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321EL2	3.64E+01	7.48E+00	1.60E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321EL21	3.69E+01	7.54E+00	1.62E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401EL2	4.43E+01	8.61E+00	1.94E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401EL21	4.54E+01	8.75E+00	1.99E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202LRC	5.82E+01	8.72E+00	3.05E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202LRC1	5.94E+01	8.83E+00	3.11E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252LRC	6.52E+01	9.50E+00	3.42E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252LRC1	6.64E+01	9.64E+00	3.48E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322LRC	7.50E+01	1.06E+01	3.94E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322LRC1	7.62E+01	1.07E+01	4.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE201L	2.66E+01	8.32E+00	2.64E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE201L100	2.70E+01	8.43E+00	2.69E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251L	2.95E+01	9.05E+00	2.93E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

WASTE CATEGORIES AND OUTPUT FLOWS		HWD	NHWD	RWD	CFR	MFR	MFEE	EE - e	EE - t
Strength (MPa)	Mix Code	kg	kg	kg	kg	kg	kg	MJ	MJ
25	QE251L100	2.99E+01	9.14E+00	2.98E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321L	3.40E+01	1.02E+01	3.40E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321L100	3.50E+01	1.04E+01	3.50E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401L	4.32E+01	1.21E+01	4.36E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401L100	4.61E+01	1.26E+01	4.68E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202L	2.56E+01	8.16E+00	2.55E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
20	QE202L100	2.62E+01	8.26E+00	2.60E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252L	2.84E+01	8.82E+00	2.82E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE252L100	2.88E+01	8.93E+00	2.87E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322L	3.09E+01	9.47E+00	3.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE322L100	3.36E+01	1.01E+01	3.35E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402L	3.98E+01	1.16E+01	3.97E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE402L100	4.22E+01	1.20E+01	4.24E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251LL2	3.05E+01	9.27E+00	3.04E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
25	QE251LL21	3.09E+01	9.37E+00	3.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321LL2	3.54E+01	1.04E+01	3.53E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
32	QE321LL21	3.64E+01	1.05E+01	3.63E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401LL2	4.76E+01	1.28E+01	4.85E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
40	QE401LL21	5.05E+01	1.33E+01	5.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Additional indicators 1m³ of ViroDecs™ ready-mix concrete

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS		PM	IRP	ETP-fw	HTP-c	HTP-nc	SQP
Strength (MPa)	Mix Code	disease incidence	kBq U-235 eq	CTUe	CTUh	CTUh	dimensionless
20	QE201E	4.75E-06	1.40E+01	1.17E+03	2.43E-08	1.09E-06	1.74E+02
20	QE201E100	4.81E-06	1.43E+01	1.18E+03	2.46E-08	1.10E-06	1.76E+02
25	QE251E	5.11E-06	1.56E+01	1.25E+03	2.61E-08	1.17E-06	1.88E+02
25	QE251E100	5.17E-06	1.59E+01	1.26E+03	2.64E-08	1.19E-06	1.90E+02
32	QE321E	5.66E-06	1.77E+01	1.36E+03	2.89E-08	1.30E-06	2.08E+02
32	QE321E100	5.77E-06	1.83E+01	1.39E+03	2.94E-08	1.33E-06	2.13E+02
40	QE401E	6.51E-06	2.16E+01	1.54E+03	3.32E-08	1.51E-06	2.41E+02
40	QE401E100	6.63E-06	2.22E+01	1.57E+03	3.38E-08	1.54E-06	2.46E+02
20	QE202E	4.72E-06	1.35E+01	1.17E+03	2.40E-08	1.08E-06	1.72E+02
20	QE202E100	4.78E-06	1.38E+01	1.18E+03	2.43E-08	1.10E-06	1.75E+02
25	QE252E	5.00E-06	1.47E+01	1.23E+03	2.54E-08	1.15E-06	1.83E+02
25	QE252E100	5.10E-06	1.53E+01	1.25E+03	2.59E-08	1.17E-06	1.87E+02
32	QE322E	5.59E-06	1.71E+01	1.35E+03	2.84E-08	1.29E-06	2.05E+02
32	QE322E100	5.72E-06	1.77E+01	1.38E+03	2.90E-08	1.32E-06	2.10E+02
40	QE402E	6.43E-06	2.07E+01	1.53E+03	3.26E-08	1.49E-06	2.37E+02
40	QE402E100	6.55E-06	2.14E+01	1.55E+03	3.33E-08	1.52E-06	2.42E+02
25	QE251EL2	5.20E-06	1.61E+01	1.28E+03	2.64E-08	1.20E-06	1.90E+02
25	QE251EL21	5.29E-06	1.65E+01	1.30E+03	2.68E-08	1.22E-06	1.93E+02
32	QE321EL2	5.79E-06	1.84E+01	1.40E+03	2.94E-08	1.34E-06	2.12E+02
32	QE321EL21	5.84E-06	1.87E+01	1.41E+03	2.96E-08	1.35E-06	2.14E+02
40	QE401EL2	6.67E-06	2.24E+01	1.59E+03	3.38E-08	1.55E-06	2.46E+02
40	QE401EL21	6.78E-06	2.30E+01	1.61E+03	3.44E-08	1.57E-06	2.50E+02
20	QE202LRC	5.44E-06	1.29E-01	1.38E+03	2.62E-08	1.29E-06	1.91E+02
20	QE202LRC1	5.49E-06	1.29E-01	1.39E+03	2.65E-08	1.30E-06	1.93E+02
25	QE252LRC	5.89E-06	1.31E-01	1.49E+03	2.84E-08	1.40E-06	2.07E+02
25	QE252LRC1	5.97E-06	1.31E-01	1.50E+03	2.87E-08	1.42E-06	2.10E+02
32	QE322LRC	6.56E-06	4.36E-02	1.64E+03	3.15E-08	1.57E-06	2.31E+02
32	QE322LRC1	6.61E-06	4.37E-02	1.65E+03	3.18E-08	1.58E-06	2.33E+02
20	QE201L	5.58E-06	1.35E+01	1.44E+03	2.78E-08	1.34E-06	1.93E+02
20	QE201L100	5.66E-06	1.37E+01	1.45E+03	2.82E-08	1.35E-06	1.96E+02
25	QE251L	6.06E-06	1.49E+01	1.55E+03	3.02E-08	1.45E-06	2.10E+02

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS		PM	IRP	ETP-fw	HTP-c	HTP-nc	SQP
Strength (MPa)	Mix Code	disease incidence	kBq U-235 eq	CTUe	CTUh	CTUh	dimensionless
25	QE251L100	6.11E-06	1.52E+01	1.56E+03	3.05E-08	1.47E-06	2.12E+02
32	QE321L	6.77E-06	1.72E+01	1.71E+03	3.38E-08	1.63E-06	2.35E+02
32	QE321L100	6.93E-06	1.77E+01	1.75E+03	3.46E-08	1.67E-06	2.41E+02
40	QE401L	7.88E-06	2.08E+01	1.97E+03	3.94E-08	1.91E-06	2.74E+02
40	QE401L100	8.03E-06	2.13E+01	2.00E+03	4.02E-08	1.95E-06	2.80E+02
20	QE202L	5.46E-06	1.30E+01	1.40E+03	2.73E-08	1.30E-06	1.90E+02
20	QE202L100	5.52E-06	1.33E+01	1.41E+03	2.75E-08	1.32E-06	1.92E+02
25	QE252L	5.88E-06	1.44E+01	1.49E+03	2.94E-08	1.41E-06	2.04E+02
25	QE252L100	5.95E-06	1.46E+01	1.51E+03	2.97E-08	1.42E-06	2.07E+02
32	QE322L	6.30E-06	1.56E+01	1.59E+03	3.14E-08	1.51E-06	2.19E+02
32	QE322L100	6.71E-06	1.70E+01	1.68E+03	3.35E-08	1.61E-06	2.34E+02
40	QE402L	7.67E-06	2.01E+01	1.91E+03	3.84E-08	1.86E-06	2.68E+02
40	QE402L100	7.83E-06	2.06E+01	1.94E+03	3.92E-08	1.89E-06	2.74E+02
25	QE251LL2	6.23E-06	1.54E+01	1.60E+03	3.09E-08	1.50E-06	2.14E+02
25	QE251LL21	6.30E-06	1.56E+01	1.62E+03	3.13E-08	1.52E-06	2.17E+02
32	QE321LL2	6.98E-06	1.78E+01	1.77E+03	3.47E-08	1.69E-06	2.41E+02
32	QE321LL21	6.92E-06	1.83E+01	1.76E+03	3.45E-08	1.67E-06	2.39E+02
40	QE401LL2	8.10E-06	2.16E+01	2.03E+03	4.05E-08	1.97E-06	2.81E+02
40	QE401LL21	8.26E-06	2.21E+01	2.07E+03	4.12E-08	2.01E-06	2.87E+02

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 CO₂

Carbonation is a natural process whereby concrete absorbs carbon dioxide (CO₂) from the atmosphere through a chemical reaction between the CO₂ in the ambient air and hydration products within the concrete (CaOH₂). 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 CO₂ emitted during the cement manufacturing process can be partly offset by the lifetime absorption of CO₂, therefore reducing the net CO₂ 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 CO₂ 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 CO₂ 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: +61 2 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-04659	
Valid From	15 September 2022	
Version	1.0	
Valid Until	15 September 2027	
Product category rules	PCR 2019:14 Construction Products, Version 1.11, 2021-02-05	
Product group classification	UN CPC 54	
Geographical Scope	Australia	
Reference Year for Data	2017 Plant Data, 2022 Mix/Materials Data	

CEN standard EN 15804:2012+A2:2019 served as the core PCR

Product category rules	PCR 2019:14 Construction Products, Version 1.11, 2019-02-05	
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 Certified 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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