Environmental Product Declaration

Environmental Product Declaration for various ready mix concrete products produced by Holcim México Operaciones S.A. de C.V. at their El Marques facility in El Marques

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers concrete products produced by Holcim México Operaciones S.A. de C.V.. Declared unit: 1 m3 of concrete
Declaration Owner:	Holcim México Operaciones S.A. de C.V. Av. Prolongación Vasco de Quiroga #4800 Torre II Ofic. 101 Piso 1, Santa Fe Cuajimalpa de Morelos Ciudad de México, México www.holcim.com.mx
Program Operator:	Labeling Sustainability 11670 W Sunset Blvd. Los Angeles, CA www.labelingsustainability.com/
Product Category Rule:	Core PCR: ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services SubPCR: NSF International (March 2020). Product Category Rul (PCR) for Environmental Product Declarations (EPD) PCR for Concrete, v2.1 Sub PCR Program Operator: NSF International Sub-category PCR review was conducted by: Thomas P. Gloria, Ph. D. of Industrial Ecology Consultants: 35 Bracebridge, Rd., Newton, MA 02459-1728, t.gloria@industrial-ecology.com. Dr. Michael Overcash of Environmental Clarity: 2908 Chipmunk Lane, Raleigh, NC 27607-3117, mrovercash@earthlink.net. Mr. Bill Stough of Sustainable Research Group: PO Box 1684, Grand Rapids, MI 49501-1684, bstough@sustainableresearchgroup.com. Mr. Jack Geilbig, EcoForm: 2624 Abelia Way, Suite 611, Knoxville, TN 37931, jgeilbig@ecoform.com.
Independent LCA Reviewer and EPD Verifier:	This EPD was independently verified in accordance with ISO 14025 and ISO 21930. The life cycle assessment was independently reviewed in accordance ISO 14044 and the referenced PCR. Independent verification of the declaration, according to ISO 14025:2006 Internal ☐ ; External X Third Party Verifier Geoffrey Guest, Certified 3rd Party Verifier under the International EPD Program (www.environdec.com), CSA Group (www.csaregistries.ca)
Date of Issue:	24 July 2023
Period of Validity:	5 years; valid until 23 July 2028
EPD Number:	aac312ec-ec24-4fcc-9384-dec2db535048

TABLE OF CONTENTS

COMPANY DESCRIPTION

Holcim Mexico produces and markets cement, ready-mix concrete, and other products and services for construction. The company has a nationwide presence through 7 cement plants with a current installed capacity to produce 12.6 million tons per year, 23 cement distribution centers, two maritime terminals, 1 Corporate Office, plus 35 ready-mix concrete plants, seven platforms, and a Geocycle transfer center, 26 commercial partners with more than 90 ready-mix concrete plants, more than 500 mixing pots, one aggregates plant and a Technological Innovation Center for Construction (CITEC).

Sustainable Development is an integral part of Lafarge Holcim's strategy around the world. Holcim Mexico has a clear vision of the future it wants for our country, which contributes to its development. Holcim Mexico's main objective is to create value. Creating value ensures long-term business success in covering the triple bottom line (i.e., social, economic, environmental values). Finally, good operating performance and a solid return on invested capital go hand in hand with sustainable development.

Holcim continues to invest in research and development. They have the Innovation and Development Center, located in Lyon (France), with satellite locations in various regions developing a comprehensive portfolio of innovators and sustainable solutions. These include different categories: inclusive business models, water management solutions, urban mining solutions (recycled aggregates), waste treatment services, energy-efficient solutions (insulating building materials), resource-efficient solutions (high recycled content, bags soluble cement), and low CO2 building materials.

Holcim operates with the belief that they can gain an advantage by developing knowledge and brand equity in the green building segment.

STUDY GOAL

The intended application of this life cycle assessment (LCA) is to comply with the procedures for creating a Type III environmental product declaration (EPD) and publish the EPD for public review on the website, http://labelingsustainability.com/ . This level of study is in accordance with EPD Product Category Rule (PCR) for Ready Mix Concrete published by NSF International (2019) and is a sub-PCR of International Standards Organization (ISO) 21930:2017 Sustainability in buildings and civil works - Core rules for EPDs of construction products and services; International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework. The performance of this study and its subsequent publishing is in alignment with the business-to-business (B2B) communication requirements for the environmental assessment of building products. The study does not intend to support comparative assertions and is intended to be disclosed to the public.

This project report was commissioned to differentiate Holcim México Operaciones S.A. de C.V. from their competition for the following reasons: generate an advantage for the organization; offer customers information to help them make informed product decisions; improve the environmental performance of Holcim México Operaciones S.A. de C.V. by continuously measuring, controlling and reducing the environmental impacts of their products; help project facilitators working on Leadership

in Energy and Environmental Design (LEED) projects achieve their credit goal; and to strengthen Holcim México Operaciones S.A. de C.V.'s license to operate in the community. The intended audience for this LCA report is Holcim México Operaciones S.A. de C.V.'s employees, their suppliers, project specifiers of their products, architects, and engineers. The EPD report is also available for policy makers, government officials interested in sustainability, academic professors, and LCA professionals. This LCA report does not include product comparisons from other facilities.

DESCRIPTION OF PRODUCT AND SCOPE

This EPD reports on 48 concrete mixes manufactured at the Holcim Mexico Operaciones S.A. de C.V. El Marques concrete facility in Queretaro, México.

This LCA assumes the impacts from products manufactured in accordance with the standards outlined in this report. This LCA is a cradle-to-gate study, and therefore, stages extending beyond the plant gate are not included in this LCA. Excluded stages include transportation of the manufactured material to the construction site; on-site construction processes and components; building (infrastructure) use and maintenance; and "end-of-life" effects.

READY MIX CONCRETE DESIGN SUMMARY

The following tables provide a list of the ready mix concrete products considered in this EPD along with key performance parameters.

Mix designs: 0 to 15 MPa

Table 1: **Declared products with Mix designs: 0 to 15MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
1	3740NB2014	0.039 MPa 28d strength Ready mix concrete	Ready mix concrete	0.039	0.4473198
2	3750NB2018	0.049 MPa 28d strength Ready mix concrete	Ready mix concrete	0.049	0.5601751
3	24005NB0518	0.49 MPa 28d strength mortars and fillers	mortars and fillers	0.490	11.0712150
4	24007NB0520	0.69 MPa 28d strength mortars and fillers	mortars and fillers	0.690	7.0665610
5	24010NB0520	0.98 MPa 28d strength mortars and fillers	mortars and fillers	0.980	5.1453314
6	24015NB0524	1.47 MPa 28d strength mortars and fillers	mortars and fillers	1.470	3.9099265
7	24020NB0520	1.96 MPa 28d strength mortars and fillers	mortars and fillers	1.960	3.3043069
8	24025NB0520	2.45 MPa 28d strength mortars and fillers	mortars and fillers	2.450	2.8021785
9	24030NB0520	2.94 MPa 28d strength mortars and fillers	mortars and fillers	2.940	2.4555775
10	77035ND2014	3.43 MPa 28d strength Ready mix concrete	Ready mix concrete	3.430	0.9079630

11	24035NB0520	3.43 MPa 28d strength mortars and fillers	mortars and fillers	3.430	2.1930539
12	77036ND2014	3.53 MPa 28d strength Ready mix concrete	Ready mix concrete	3.530	0.8847387
13	77038ND2014	3.73 MPa 28d strength Ready mix concrete	Ready mix concrete	3.730	0.8446294
14	77040ND2014	3.92 MPa 28d strength Ready mix concrete	Ready mix concrete	3.920	0.8200484
15	24040NB0520	3.92 MPa 28d strength mortars and fillers	mortars and fillers	3.920	1.9904975
16	77042NB4014	4.12 MPa 28d strength Ready mix concrete	Ready mix concrete	4.120	0.7519819
17	60042ND1210	4.12 MPa 28d strength special concrete	special concrete	4.120	0.7336957
18	77045NB2014	4.41 MPa 28d strength Ready mix concrete	Ready mix concrete	4.410	0.7444087
19	39048ND4012	4.71 MPa 28d strength Ready mix concrete	Ready mix concrete	4.710	0.6455207
20	39050ND4006	4.9 MPa 28d strength Ready mix concrete	Ready mix concrete	4.900	0.6059770
21	24050NB0518	4.9 MPa 28d strength mortars and fillers	mortars and fillers	4.900	1.7511933
22	60075NB0514	7.36 MPa 28d strength special concrete	special concrete	7.360	1.4103379
23	24075NB0518	7.36 MPa 28d strength mortars and fillers	mortars and fillers	7.360	1.4377332
24	01100NB2018	9.81 MPa 28d strength Ready mix concrete	Ready mix concrete	9.810	1.4575794
25	11100NB0514	9.81 MPa 28d strength mortars and fillers	mortars and fillers	9.810	1.2986012
26	70150ND2014	14.71 MPa 28d strength Ready mix concrete	Ready mix concrete	14.710	1.0479242
27	76150NB1218	14.71 MPa 28d strength special concrete	special concrete	14.710	0.9268930
28	11150NB0514	14.71 MPa 28d strength mortars and fillers	mortars and fillers	14.710	1.1057185

Mix designs: 15 to 20 MPa

Table 2: **Declared products with Mix designs: 15 to 20MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
29	70175NB2018	17.16 MPa 28d strength Ready mix concrete	Ready mix concrete	17.16	1.1987448
30	01200NB2014	19.61 MPa 28d strength Ready mix concrete	Ready mix concrete	19.61	1.0632298
31	27200NB1200	19.61 MPa 28d strength special concrete	special concrete	19.61	0.0000000
32	11200NB0514	19.61 MPa 28d strength mortars and fillers	mortars and fillers	19.61	0.9448687

Mix designs: 21 to 25 MPa

Table 3: **Declared products with Mix designs: 21 to 25MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
33	71210ND1210	20.59 MPa 28d strength Ready mix concrete	Ready mix concrete	20.59	1.0436787
34	70250NB2014	24.52 MPa 28d strength Ready mix concrete	Ready mix concrete	24.52	0.8618666
35	40250NB1214	24.52 MPa 28d strength special concrete	special concrete	24.52	0.7509120

Mix designs: 26 to 30 MPa

Table 4: **Declared products with Mix designs: 26 to 30MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
36	70280NB2018	27.46 MPa 28d strength Ready mix concrete	Ready mix concrete	27.46	0.8931665
37	04300NB2018	29.42 MPa 28d strength Ready mix concrete	Ready mix concrete	29.42	0.8021774

Mix designs: 31 to 35 MPa

Table 5: **Declared products with Mix designs: 36 to 40MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
38	60316NB2014	30.99 MPa 28d strength special concrete	special concrete	30.99	0.4781818
39	70320ND2010	31.38 MPa 28d strength Ready mix concrete	Ready mix concrete	31.38	0.7859502
40	01350NB2018	34.32 MPa 28d strength Ready mix concrete	Ready mix concrete	34.32	0.7408051
41	60350NB2022	34.32 MPa 28d strength special concrete	special concrete	34.32	0.6669565

Mix designs: 36 to 40 MPa

Table 6: **Declared products with Mix designs: 36 to 40MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
42	70360ND2014	35.3 MPa 28d strength Ready mix concrete	Ready mix concrete	35.30	0.7009156
43	70400ND2014	39.23 MPa 28d strength Ready mix concrete	Ready mix concrete	39.23	0.6291619
44	60400NB1265	39.23 MPa 28d strength special concrete	special concrete	39.23	0.4313725

Mix designs: 41 to 45 MPa

Table 7: **Declared products with Mix designs: 41 to 45MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
45	13450NB2018	44.13 MPa 28d strength Ready mix concrete	Ready mix concrete	44.13	0.5323994
46	60450NB2022	44.13 MPa 28d strength special concrete	special concrete	44.13	0.5340909

Mix designs: 51 to 55 MPa

Table 8: **Declared products with Mix designs: 51 to 55MPa considered in this environmental product declaration**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
47	13550NB2018	53.94 MPa 28d strength Ready mix concrete	Ready mix concrete	53.94	0.4470170
48	60550NB2022	53.94 MPa 28d strength special concrete	special concrete	53.94	0.4485981

READY MIX CONCRETE DESIGN COMPOSITION

The following figures provide mass breakdown (kg per functional unit) of the material composition of each ready mix concrete design considered. Please note that the presented breakdown has been randomly altered by +/-10%, and is therefore only an approximation; this manipulation is to ensure confidentiality.

Table 9: **Design composition**

Product Components	Raw Material, weight%
Cement	Proprietary
Aggregates	30-60.00
Others	0.01-5.00

Total	100.00

SYSTEM BOUNDARIES

The following figure depicts the cradle-to-gate system boundary considered in this study:

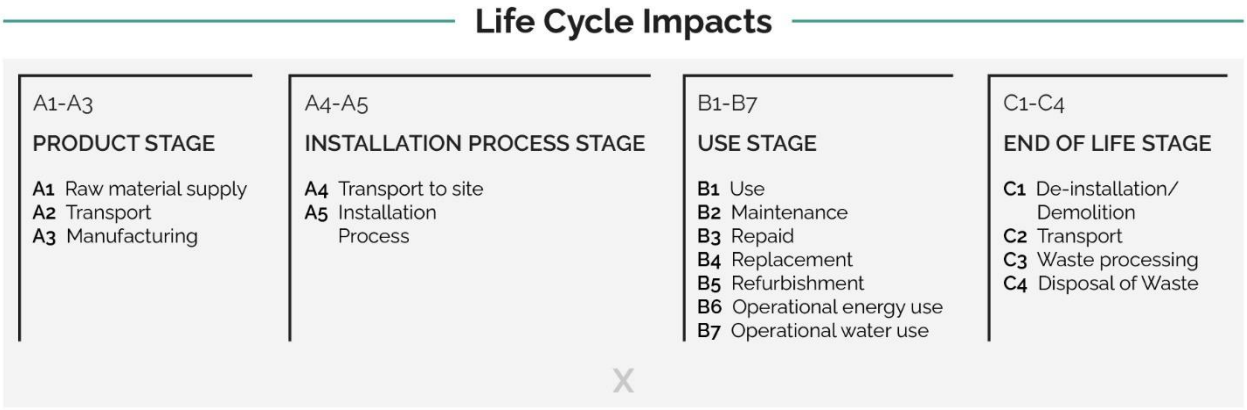

Figure 1: **General life cycle phases for consideration in a construction works system**

This is a Cradle-to-gate life cycle assessment and the following life cycle stages are included in the study:

- A1: Raw material supply (upstream processes) - Extraction, handling, and processing of the materials used in manufacturing the declared products in this LCA.
- A2: Transportation - Transportation of A1 materials from the supplier to the "gate" of the manufacturing facility (i.e. A3).
- A3: Manufacturing (core processes)- The energy and other utility inputs used to store, move, and manufacturer the declared products and to operate the facility.

As according to the PCR, the following figure illustrates the general activities and input requirements for producing ready mix concrete products and is not necessarily exhaustive.

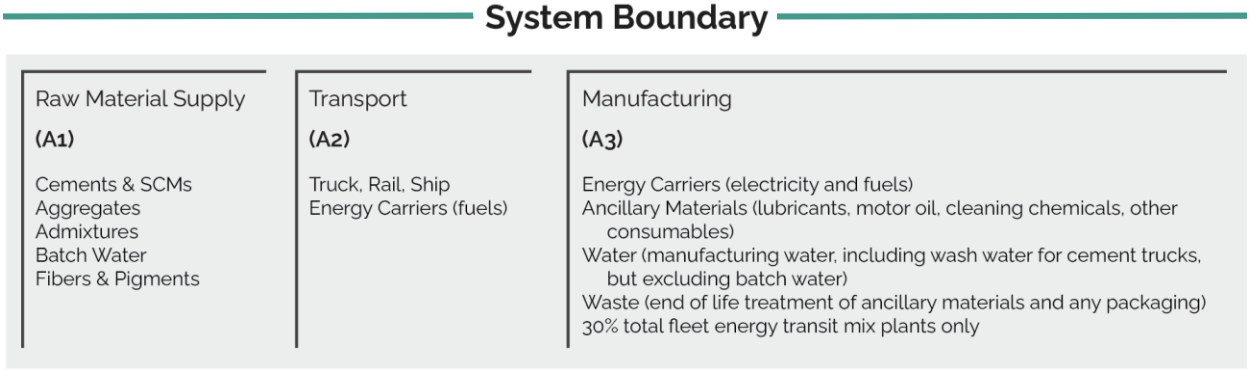

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

In addition, as according to the relevant PCR, the following requirements are excluded from this study:

- Production, manufacture and construction of A3 building/capital goods and infrastructure;
- Production and manufacture of steel production equipment, steel delivery vehicles, earth-moving equipment, and laboratory equipment;
- Personnel-related activities (travel, furniture, office supplies);
- Energy use related to company management and sales activities.

For this LCA the manufacturing plant, owned and operated by Holcim México Operaciones S.A. de C.V., is located at their Planta El Marques facility in México. All operating data is formulated using the actual data from Holcim México Operaciones S.A. de C.V.'s plant at the above location, including water, energy consumption and waste generation. All inputs for this system boundary are calculated for the plant.

This life cycle inventory was organized in a spreadsheet and was then input into an RStudio environment where pre-calculated LCIA results for relevant products/activities stemming from the ecoinvent v3.8 database and a local EPD database in combination with primary data from Holcim México Operaciones S.A. de C.V. were utilized. Explanations of the contribution of each data source to this study are outlined in the section 'Data Sources and Quality'. Further LCI details for each declared product are provided in the sections 'Detailed LCI tables' and 'Transport tables' of the detailed LCA report. A parameter uncertainty analysis was also performed where key statistical results (e.g. min/mean/max etc.) are provided in the detailed LCA report.

CUT-OFF CRITERIA

ISO 14044:2006 and the focus PCR requires the LCA model to contain a minimum of 95% of the total inflows (mass and energy) to the upstream and core modules be included in this study. The cut-off criteria were applied to all other processes unless otherwise noted above as follows. A 1% cut-off is considered for all renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process where the total of the neglected inputs does not exceed 5%.

DATA SOURCES AND DATA QUALITY ASSESSMENT

Raw material transport: A combination of actual mode/distance combinations were assumed for key bulk materials whereas ecoinvent default multi-modal market mix distances were assumed for other inputs where no original data could be provided.

Electricity: Electricity consumption values are for Holcim Mexico in calendar year 2022. These values were direct reported from Holcim records. The unit process "market for electricity, medium voltage/electricity, medium voltage/MX/kWh" was used to represent the Mexico grid electricity used by the concrete plant.

Process/space heating: No fuel is used for space heating at this plant.

Fuel required for machinery: Machinery-related fuel requirements were determined from direct Holcim information. The types of machinery used include generators, pumps to pump concrete to higher elevations, and transportation equipment used for moving materials.

Waste generation: Waste generation values are directly reported from Holcim operations for both bulk waste and hazardous waste. No High-level radioactive waste is generated on-site at this facility. Wash water values are direct reported water use from Holcim México for 2022.

Recovered energy: Not applicable.

Recycled/reused material/components: The amount of returned concrete is based on Holcim primary data for the reference year, 2022..

Module A1 material losses: Due to lack of data, default loss factors of 5% were assumed. The PCR states" A3 shall include an assumption of 5% material loss unless product specific data is available and transparently reported in the project LCA report underlying the EPD;"

Direct A3 emissions accounting: Direct emissions are modeled using fuel and technology appropriate ecoinvent activities. See LCI input tables for details.

Waste transport requirements: Transportation distances are using estimated values. The waste hauler cannot guarantee the exact distances traveled due to the variation of route and actual location of disposal. Most waste disposal sites are near the plant therefore the 25 km distance is a representative estimate. Returned concrete and wash water, measured in kilograms, is based on direct Holcim reporting for the reference year 2022.

Product transport requirements: The diesel fuel used by the mixing trucks is direct primary information reported from Holcim México records for the year 2022. The concrete PCR allots 30% of the overall mixing truck total for stage A3 (manufacturing) for mixing the materials.

The following tables depict a list of assumed life cycle inventory utilized in the LCA modeling to generate the impact results across the life cycle modules in scope. An assessment of the quality of each LCI activities utilized from various sources is also provided.

Table 10: **LCI inputs assumed for module A1 (i.e. raw material supply)** ***Data Quality Assessment Key Fair=1, Good=2, Very Good =3.***

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Andesite sand	basalt quarry operation/basalt/RoW/kg; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.8	Querétaro	v3.8 in 2021	2	3	1	3	3
Water	tap water production, conventional with	ecoinvent v3.8	Queretaro	v3.8 in 2021	2	3	1	3	3

	biological treatment/tap water/RoW/kg								
Gravel	limestone quarry operation/limestone, unprocessed/RoW/kg; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.8	Queretaro	v3.8 in 2021	2	3	1	3	3
Additives	market for chemical, organic/chemical, organic/GLO/kg	ecoinvent v3.8	Estado de Mexico	v3.8 in 2021	2	3	1	3	3
Silica fume	market for silica fume, densified | silica fume, densified | Cutoff, S	ecoinvent v3.8	Tabasco	v3.8 in 2021	3	3	3	3	3
Cement (CPC 40) - PROVEEDOR: HOLCIM MACUSPANA	CPC 40	Progam Operator: Labeling Sustainability - EPD ID: 09cddb67-dd75-4879-9c7d-74d4664d8e10	Tabasco	30 November 2021	3	NA	3	3	3

DATA QUALITY ASSESSMENT

Data quality/variability requirements, as specified in the PCR, are applied. This section describes the achieved data quality relative to the ISO 14044:2006 requirements. Data quality is judged based on its precision (measured, calculated, or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied within a study serving as a data source) and representativeness (geographical, temporal, and technological).

Precision: Through measurement and calculation, the manufacturers collected and provided primary data on their annual production. For accuracy, the LCA practitioner and 3rd Party Verifier validated the plant gate-to-gate data.

Completeness: All relevant specific processes, including inputs (raw materials, energy, and ancillary materials) and outputs (emissions and production volume) were considered and modeled to represent the specified and declared products. The majority of relevant background materials and processes were taken from ecoinvent v3.8 LCI datasets where relatively recent region-specific electricity inputs were utilized. The most relevant EPDs requiring key A1 inputs were also utilized where readily available.

Consistency: To ensure consistency, the same modeling structure across the respective product systems was utilized for all inputs, which consisted of raw material inputs and ancillary material, energy flows, water resource inputs, product, and co-products outputs, returned and recovered Ready Mix Concrete materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the ecoinvent v3.8 database were used across all product

systems. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in a machine readable project file for all foreground and background processes, and in Labeling Sustainability's proprietary Ready Mix Concrete LCA calculator* for all production facility and product-specific calculations. A considerable level of transparency is provided throughout the detailed LCA report as the specifications and material quantity make-up for the declared products are presented and key primary and secondary LCI data sources are summarized. The provision of more detailed publicly accessible data to allow full external reproducibility was not possible due to reasons of confidentiality.

*Labeling Sustainability has developed a proprietary tool that allows the calculation of PCR-compliant LCA results for Ready Mix Concrete product designs. The tool auto-calculates results by scaling base-unit technosphere inputs (i.e. 1 kg sand, 1 kWh electricity, etc.) to replicate the reference flow conversions that take place in any typical LCA software like openLCA or SimaPro. The tool was tested against several LCAs performed in openLCA and the tool generated identical results to those realized in openLCA across every impact category and inventory metric (where comparisons could be readily made).

Representativeness: The representativeness of the data is summarized as follows.

- Time related coverage of the manufacturing processes' primary collected data from 2022-01-01 to 2022-12-31.
- Upstream (background) LCI data was either the PCR specified default (if applicable) or more appropriate LCI datasets as found in the country-adjusted ecoinvent v3.8 database.
- Geographical coverage for inputs required by the A3 facility(ies) is representative of its region of focus; other upstream and background processes are based on US, North American, or global average data and adjusted to regional electricity mixes when relevant.
- Technological coverage is typical or average and specific to the participating facilities for all primary data.

ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

Per the PCR, this EPD supports the life cycle impact assessment indicators and inventory metrics as listed in the tables below. As specified in the PCR, the most recent US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), impact categories were utilized as they provide a North American context for the mandatory category indicators to be included in the EPD. Additionally, the PCR requires a set of inventory metrics to be reported with the LCIA indicators (see tables below).

It should be noted that emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in any of the following categories.

LIMITATIONS

This EPD is a declaration of potential environmental impact and does not support or provide definitive comparisons of the environmental performance of specific products. Only EPDs prepared from cradle-to-grave life cycle results and based on the same function and reference service life and quantified by the same functional unit can be used to assist purchasers and users in making informed comparisons between products.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. Further, LCA offers a wide array of environmental impact indicators, and this EPD reports a collection of those, as specified by the PCR.

In addition to the impact results, this EPD provides several metrics related to resource consumption and waste generation. While these data may be informational in other ways, they do not provide a measure of impact on the environment

TOTAL IMPACT SUMMARY

The following table reports the total LCA results for each product produced at the given ready mix concrete facility on a per 1m3 of concrete basis.

Mix designs: 0 to 15 MPa

Table 11: **Total life cycle (across modules in scope) impact results for Mix designs: 0 to 15MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H+-Eq	kg N	kg CO2-Eq	kg CFC-11-Eq	kg NOx-Eq	kg Sb-Eq	MJ, net calorific value
Minimum	609	0.686	566	1.61e-05	14.4	0.00207	1490
Maximum	286	0.337	281	9.83e-06	6.73	0.00102	912
Mean	289	0.338	280	9.53e-06	6.8	0.001	896
Median	609	0.686	566	1.61e-05	14.4	0.00207	1490
3740NB2014	609	0.686	566	1.61e-05	14.4	0.00207	1480
3750NB2018	517	0.588	490	1.52e-05	12.2	0.00183	1490
24005NB0518	50.4	0.0812	71.1	4.82e-06	1.12	0.00023	455
24007NB0520	72.5	0.105	90.6	5.2e-06	1.65	0.000302	492
24010NB0520	94.6	0.129	110	5.55e-06	2.18	0.000373	526
24015NB0524	130	0.167	140	6.08e-06	3.02	0.000486	579
24020NB0520	139	0.177	148	6.28e-06	3.23	0.000514	595
24025NB0520	161	0.201	168	6.7e-06	3.76	0.000587	636
24030NB0520	183	0.225	187	7.02e-06	4.28	0.000656	666
77035ND2014	312	0.366	308	1.16e-05	7.33	0.00113	1030
24035NB0520	205	0.248	206	7.35e-06	4.81	0.000726	698
77036ND2014	319	0.374	314	1.17e-05	7.49	0.00115	1040
77038ND2014	332	0.388	325	1.19e-05	7.8	0.00119	1060

77040ND2014	345	0.402	336	1.2e-05	8.11	0.00123	1080
24040NB0520	227	0.272	225	7.67e-06	5.33	0.000795	727
77042NB4014	363	0.422	353	1.26e-05	8.55	0.00129	1120
60042ND1210	418	0.48	399	1.29e-05	9.86	0.00145	1160
77045NB2014	382	0.442	369	1.26e-05	9	0.00135	1130
39048ND4012	404	0.466	390	1.35e-05	9.52	0.00144	1240
39050ND4006	421	0.484	405	1.38e-05	9.92	0.0015	1270
24050NB0518	269	0.317	262	8.31e-06	6.33	0.000934	803
60075NB0514	263	0.311	256	8.05e-06	6.19	0.00091	775
24075NB0518	289	0.338	280	8.83e-06	6.79	0.000998	850
01100NB2018	212	0.258	220	9.82e-06	4.95	0.000802	862
11100NB0514	289	0.339	280	8.58e-06	6.81	0.00101	860
70150ND2014	243	0.292	249	1.07e-05	5.69	0.000911	943
76150NB1218	432	0.493	403	1.11e-05	10.2	0.00146	1040
11150NB0514	334	0.387	318	9.25e-06	7.87	0.00115	929

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**	**CBWC**	**CWWC**	**CHW**	**CNHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	496	0	486	14.2	0.000792	0.558	28.2	0.000917	0.23	5.03e-06	0.0419	15
Maximum	1690	97.9	1600	46.5	0.00783	0.978	65.6	0.00305	0.447	5.03e-06	0.0419	15
Mean	1030	46.7	977	28.4	0.00382	0.715	44.9	0.00186	0.332	5.03e-06	0.0419	15
Median	1020	49.4	962	28	0.00382	0.706	43.8	0.0018	0.34	5.03e-06	0.0419	15
3740NB2014	1690	97.9	1590	46.5	0.00783	0.978	65.6	0.00305	0.254	5.03e-06	0.0419	15
3750NB2018	1690	85	1600	45.6	0.00695	0.905	61.9	0.00284	0.269	5.03e-06	0.0419	15
24005NB0518	496	0	486	14.2	0.000792	0.558	28.2	0.000917	0.428	5.03e-06	0.0419	15
24007NB0520	538	15.8	524	15.4	0.00108	0.576	29.4	0.000986	0.421	5.03e-06	0.0419	15
24010NB0520	581	19.5	562	16.4	0.00138	0.594	30.5	0.00105	0.415	5.03e-06	0.0419	15
24015NB0524	645	25.1	619	18.2	0.00185	0.665	32.1	0.00114	0.447	5.03e-06	0.0419	15
24020NB0520	662	0	634	18.7	0.00199	0.633	32.7	0.00118	0.405	5.03e-06	0.0419	15
24025NB0520	710	30.3	675	20.1	0.00226	0.656	33.9	0.00126	0.402	5.03e-06	0.0419	15
24030NB0520	749	33.7	711	21	0.0025	0.682	34.9	0.00132	0.404	5.03e-06	0.0419	15
77035ND2014	1160	48.7	1110	31.7	0.00417	0.667	51.9	0.00221	0.259	5.03e-06	0.0419	15

24035NB0520	787	37.3	746	22.2	0.00277	0.708	35.9	0.00138	0.407	5.03e-06	0.0419	15
77036ND2014	1170	50.2	1120	31.9	0.00422	0.673	52.2	0.00223	0.258	5.03e-06	0.0419	15
77038ND2014	1200	52	1140	32.6	0.00445	0.686	52.9	0.00227	0.257	5.03e-06	0.0419	15
77040ND2014	1220	54.9	1150	33.2	0.00461	0.704	53	0.00229	0.26	5.03e-06	0.0419	15
24040NB0520	821	40.5	776	23.1	0.00303	0.736	36.9	0.00144	0.411	5.03e-06	0.0419	15
77042NB4014	1270	57.3	1200	34.5	0.00481	0.714	55	0.0024	0.251	5.03e-06	0.0419	15
60042ND1210	1320	66.8	1250	36.1	0.00535	0.803	55.9	0.00246	0.284	5.03e-06	0.0419	15
77045NB2014	1280	60.9	1210	35	0.00502	0.745	54.8	0.00239	0.262	5.03e-06	0.0419	15
39048ND4012	1400	64.1	1320	38	0.00538	0.748	57.7	0.00255	0.24	5.03e-06	0.0419	15
39050ND4006	1440	67.2	1360	39	0.00572	0.761	58.8	0.00262	0.235	5.03e-06	0.0419	15
24050NB0518	911	48	864	25.5	0.00353	0.803	38.7	0.00155	0.431	5.03e-06	0.0419	15
60075NB0514	882	46.6	825	24.6	0.00349	0.699	38	0.00151	0.34	5.03e-06	0.0419	15
24075NB0518	962	51.4	912	27.1	0.0038	0.775	40.2	0.00165	0.38	5.03e-06	0.0419	15
01100NB2018	961	32.6	926	26.2	0.00293	0.576	46.5	0.00189	0.277	5.03e-06	0.0419	15
11100NB0514	961	32.6	926	26.2	0.00293	0.576	46.5	0.00189	0.277	5.03e-06	0.0419	15
70150ND2014	1050	37.9	1010	28.6	0.00324	0.563	49.4	0.00206	0.23	5.03e-06	0.0419	15
76150NB1218	1200	72.3	1120	33	0.00559	0.907	48.4	0.00208	0.373	5.03e-06	0.0419	15
11150NB0514	1060	60.1	998	29.4	0.00437	0.78	41.2	0.00172	0.341	5.03e-06	0.0419	15

Mix designs: 15 to 20 MPa

Table 12: **Total life cycle (across modules in scope) impact results for Mix designs: 15 to 20MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H+-Eq	kg N	kg CO2-Eq	kg CFC-11-Eq	kg NOx-Eq	kg Sb-Eq	MJ, net calorific value
Minimum	274	0.326	276	9.79e-06	6.43	0.00102	957
Maximum	394	0.454	375	1.18e-05	9.3	0.00133	1020
Mean	331	0.386	321	1.08e-05	7.79	0.00116	995

Median	328	0.382	316	1.09e-05	7.72	0.00115	1000
70175NB2018	276	0.327	276	1.07e-05	6.47	0.00102	994
01200NB2014	274	0.326	276	1.11e-05	6.43	0.00102	1010
27200NB1200	394	0.454	375	1.18e-05	9.3	0.00133	1020
11200NB0514	379	0.436	357	9.79e-06	8.96	0.00128	957

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**	**CBWC**	**CWWC**	**CHW**	**CNHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	1100	43.2	1030	30.4	0.00373	0.491	43.1	0.00183	0	5.03e-06	0.0419	15
Maximum	1170	65.8	1100	32.7	0.00513	0.817	51.2	0.00226	0.333	5.03e-06	0.0419	15
Mean	1120	54.7	1070	31.1	0.0044	0.654	48.2	0.00206	0.225	5.03e-06	0.0419	15
Median	1120	55	1070	30.6	0.00438	0.654	49.2	0.00206	0.283	5.03e-06	0.0419	15
70175NB2018	1110	45.4	1060	30.4	0.00371	0.675	48.3	0.00203	0.301	5.03e-06	0.0419	15
01200NB2014	1120	43.2	1080	30.6	0.0037	0.633	50.1	0.0021	0.265	5.03e-06	0.0419	15
27200NB1200	1170	64.5	1100	32.7	0.00513	0.491	51.2	0.00226	0	5.03e-06	0.0419	15
11200NB0514	1100	65.8	1030	30.6	0.00504	0.817	43.1	0.00183	0.333	5.03e-06	0.0419	15

Mix designs: 21 to 25 MPa

Table 13: **Total life cycle (across modules in scope) impact results for Mix designs: 21 to 25MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	**AP**	**EP**	**GWP**	**ODP**	**PCOP**	**ADPe**	**ADPf**
Unit	**moles of H+-Eq**	**kg N**	**kg CO2-Eq**	**kg CFC-11-Eq**	**kg NOx-Eq**	**kg Sb-Eq**	**MJ, net calorific value**
Minimum	308	0.362	302	1.07e-05	7.25	0.0011	972
Maximum	423	0.485	401	1.21e-05	9.98	0.00145	1130
Mean	349	0.406	338	1.15e-05	8.21	0.00123	1050
Median	315	0.37	311	1.18e-05	7.4	0.00114	1040
71210ND1210	308	0.362	302	1.07e-05	7.25	0.0011	972
70250NB2014	315	0.37	311	1.18e-05	7.4	0.00114	1040
40250NB1214	423	0.485	401	1.21e-05	9.98	0.00145	1130

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NRR	RR	WDP	LFW	LFHW	CBWC	CWWC	CHW	CNHW
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	1100	48.9	1040	30.2	0.00415	0.659	48.4	0.00204	0.248	5.03e-06	0.0419	15
Maximum	1290	69.1	1210	35.6	0.00549	0.827	52.6	0.00229	0.295	5.03e-06	0.0419	15
Mean	1190	55.9	1120	32.6	0.00462	0.729	50.9	0.00219	0.279	5.03e-06	0.0419	15
Median	1170	49.6	1120	31.9	0.00422	0.701	51.8	0.00225	0.294	5.03e-06	0.0419	15
71210ND1210	1100	49.6	1040	30.2	0.00415	0.701	48.4	0.00204	0.295	5.03e-06	0.0419	15
70250NB2014	1170	48.9	1120	31.9	0.00422	0.659	52.6	0.00225	0.248	5.03e-06	0.0419	15
40250NB1214	1290	69.1	1210	35.6	0.00549	0.827	51.8	0.00229	0.294	5.03e-06	0.0419	15

Mix designs: 26 to 30 MPa

Table 14: **Total life cycle (across modules in scope) impact results for Mix designs: 26 to 30MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H+-Eq	kg N	kg CO2-Eq	kg CFC-11-Eq	kg NOx-Eq	kg Sb-Eq	MJ, net calorific value
Minimum	352	0.41	344	1.18e-05	8.28	0.00126	1070
Maximum	356	0.413	344	1.23e-05	8.38	0.00127	1140
Mean	354	0.412	344	1.21e-05	8.33	0.00126	1100
Median	354	0.412	344	1.21e-05	8.33	0.00126	1100
70280NB2018	356	0.413	344	1.18e-05	8.38	0.00126	1070
04300NB2018	352	0.41	344	1.23e-05	8.28	0.00127	1140

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NRR	RR	WDP	LFW	LFHW	CBWC	CWWC	CHW	CNHW
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	1210	56.7	1140	33.1	0.00459	0.711	52.1	0.00224	0.259	5.03e-06	0.0419	15

Maximum	1280	57.4	1220	34.8	0.00465	0.749	54.1	0.00234	0.292	5.03e-06	0.0419	15
Mean	1240	57	1180	34	0.00462	0.73	53.1	0.00229	0.275	5.03e-06	0.0419	15
Median	1240	57	1180	34	0.00462	0.73	53.1	0.00229	0.275	5.03e-06	0.0419	15
70280NB2018	1210	57.4	1140	33.1	0.00465	0.749	52.1	0.00224	0.292	5.03e-06	0.0419	15
04300NB2018	1280	56.7	1220	34.8	0.00459	0.711	54.1	0.00234	0.259	5.03e-06	0.0419	15

Mix designs: 31 to 35 MPa

Table 15: **Total life cycle (across modules in scope) impact results for Mix designs: 31 to 35MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	**AP**	**EP**	**GWP**	**ODP**	**PCOP**	**ADPe**	**ADPf**
Unit	**moles of H+-Eq**	**kg N**	**kg CO2-Eq**	**kg CFC-11-Eq**	**kg NOx-Eq**	**kg Sb-Eq**	**MJ, net calorific value**
Minimum	379	0.439	366	1.24e-05	8.94	0.00133	1110
Maximum	618	0.697	574	1.61e-05	14.6	0.00211	1490
Mean	447	0.512	425	1.35e-05	10.6	0.00156	1220
Median	396	0.456	380	1.28e-05	9.34	0.00139	1140
60316NB2014	618	0.697	574	1.61e-05	14.6	0.00211	1490
70320ND2010	379	0.439	366	1.24e-05	8.94	0.00133	1110
01350NB2018	399	0.46	383	1.27e-05	9.42	0.0014	1140
60350NB2022	392	0.453	377	1.28e-05	9.25	0.00138	1130

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**	**CBWC**	**CWWC**	**CHW**	**CNHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	1260	62	1190	34.5	0.00503	0.73	54.1	0.00236	0.242	5.03e-06	0.0419	15
Maximum	1710	98.4	1600	46.7	0.00803	1.01	65.6	0.00305	0.276	5.03e-06	0.0419	15
Mean	1390	71.5	1310	37.9	0.00586	0.817	57.9	0.00257	0.266	5.03e-06	0.0419	15
Median	1290	62.8	1220	35.2	0.0052	0.764	55.9	0.00244	0.274	5.03e-06	0.0419	15
60316NB2014	1710	98.4	1600	46.7	0.00803	1.01	65.6	0.00305	0.276	5.03e-06	0.0419	15
70320ND2010	1260	62	1190	34.5	0.00503	0.756	54.1	0.00236	0.275	5.03e-06	0.0419	15

01350NB2018	1300	63.6	1230	35.5	0.00525	0.773	55.4	0.00242	0.273	5.03e-06	0.0419	15
60350NB2022	1280	62	1210	35	0.00514	0.73	56.4	0.00246	0.242	5.03e-06	0.0419	15

Mix designs: 36 to 40 MPa

Table 16: **Total life cycle (across modules in scope) impact results for Mix designs: 41 to 45MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	**AP**	**EP**	**GWP**	**ODP**	**PCOP**	**ADPe**	**ADPf**
Unit	**moles of H+-Eq**	**kg N**	**kg CO2-Eq**	**kg CFC-11-Eq**	**kg NOx-Eq**	**kg Sb-Eq**	**MJ, net calorific value**
Minimum	446	0.511	424	1.34e-05	10.5	0.00156	1250
Maximum	574	0.648	531	1.5e-05	13.6	0.0019	1270
Mean	504	0.573	473	1.41e-05	11.9	0.00172	1260
Median	492	0.56	463	1.39e-05	11.6	0.00169	1250
70360ND2014	446	0.511	424	1.34e-05	10.5	0.00156	1250
70400ND2014	492	0.56	463	1.39e-05	11.6	0.00169	1270
60400NB1265	574	0.648	531	1.5e-05	13.6	0.0019	1250

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**	**CBWC**	**CWWC**	**CHW**	**CNHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	1420	72	1340	38.6	0.00583	0.844	57	0.00254	0.231	5.03e-06	0.0419	15
Maximum	1450	87.3	1360	40	0.00742	0.907	63.2	0.00289	0.289	5.03e-06	0.0419	15
Mean	1440	79	1350	39.4	0.00657	0.88	59.6	0.00269	0.269	5.03e-06	0.0419	15
Median	1440	77.8	1340	39.7	0.00645	0.889	58.7	0.00265	0.288	5.03e-06	0.0419	15
70360ND2014	1420	72	1340	38.6	0.00583	0.844	57	0.00254	0.289	5.03e-06	0.0419	15
70400ND2014	1450	77.8	1360	39.7	0.00645	0.889	58.7	0.00265	0.288	5.03e-06	0.0419	15
60400NB1265	1440	87.3	1340	40	0.00742	0.907	63.2	0.00289	0.231	5.03e-06	0.0419	15

Mix designs: 41 to 45 MPa

Table 17: **Total life cycle (across modules in scope) impact results for Mix designs: 41 to 45MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H+-Eq	kg N	kg CO2-Eq	kg CFC-11-Eq	kg NOx-Eq	kg Sb-Eq	MJ, net calorific value
Minimum	498	0.567	470	1.45e-05	11.8	0.00171	1300
Maximum	508	0.577	477	1.46e-05	12	0.00174	1300
Mean	503	0.572	474	1.46e-05	11.9	0.00172	1300
Median	503	0.572	474	1.46e-05	11.9	0.00172	1300
13450NB2018	508	0.577	477	1.45e-05	12	0.00174	1300
60450NB2022	498	0.567	470	1.46e-05	11.8	0.00171	1300

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NRR	RR	WDP	LFW	LFHW	CBWC	CWWC	CHW	CNHW
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	1480	76.8	1390	40.5	0.0065	0.85	61.1	0.00276	0.247	5.03e-06	0.0419	15
Maximum	1490	78.1	1400	40.7	0.00663	0.864	61.6	0.00279	0.251	5.03e-06	0.0419	15
Mean	4	77.4	1400	40.6	0.00656	0.857	61.4	0.00277	0.249	5.03e-06	0.0419	15
Median	1480	77.4	1400	40.6	0.00656	0.857	61.4	0.00277	0.249	5.03e-06	0.0419	15
13450NB2018	1480	78.1	1390	40.5	0.00663	0.864	61.1	0.00276	0.251	5.03e-06	0.0419	15
60450NB2022	1490	76.8	1400	40.7	0.0065	0.85	61.6	0.00279	0.247	5.03e-06	0.0419	15

Mix designs: 51 to 55 MPa

Table 18: **Total life cycle (across modules in scope) impact results for Mix designs: 51 to 55MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H+-Eq	kg N	kg CO2-Eq	kg CFC-11-Eq	kg NOx-Eq	kg Sb-Eq	MJ, net calorific value
Minimum	601	0.678	558	1.58e-05	14.2	0.00203	1420
Maximum	602	0.679	560	1.61e-05	14.3	0.00204	1430

Mean	602	0.679	559	1.6e-05	14.2	0.00204	1420
Median	602	0.679	559	1.6e-05	14.2	0.00204	1420
13550NB2018	601	0.678	558	1.58e-05	14.2	0.00203	1420
60550NB2022	602	0.679	560	1.61e-05	14.3	0.00204	1430

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NRR	RR	WDP	LFW	LFHW	CBWC	CWWC	CHW	CNHW
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	1630	94.6	1530	44.8	0.00778	0.963	65.1	0.00301	0.251	5.03e-06	0.0419	15
Maximum	1640	97.1	1540	45.1	0.00784	0.966	66	0.00306	0.252	5.03e-06	0.0419	15
Mean	1640	95.8	1540	45	0.00781	0.964	65.6	0.00304	0.252	5.03e-06	0.0419	15
Median	1640	95.8	1540	45	0.00781	0.964	65.6	0.00304	0.252	5.03e-06	0.0419	15
13550NB2018	1630	94.6	1530	44.8	0.00784	0.963	65.1	0.00301	0.251	5.03e-06	0.0419	15
60550NB2022	1640	97.1	1540	45.1	0.00778	0.966	66	0.00306	0.252	5.03e-06	0.0419	15

ADDITIONAL ENVIRONMENTAL INFO

No regulated substances of very high concern are utilized on site.

REFERENCES

ASTM Standards:

- ASTM A36/A36M Standard Specification for Carbon Structural Steel
- ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A184 Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
- ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
- ASTM A416/A416M Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
- ASTM A555/A555M Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods

- ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- ASTM A767/A767M Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
- ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars
- ASTM A820/A820M Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
- ASTM A884/A884M Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
- ASTM A934/A934M Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
- ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- ASTM C33/C33M Standard Specification for Concrete Aggregates
- ASTM C94 Standard Specification for Ready-Mixed Concrete
- ASTM C150/C150M Standard Specification for Portland Cement
- ASTM C260/C260M Standard Specification for Air-Entraining Admixtures for Concrete
- ASTM C595 Standard Specification for Blended Hydraulic Cements
- ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- ASTM C979/C979M Standard Specification for Pigments for Integrally Colored Concrete
- ASTM C989/C989M Standard Specification for Slag Cement for Use in Concrete and Mortars
- ASTM C1017/C1017M Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete
- ASTM C1157/C1157M Standard Performance Specification for Hydraulic Cement
- ASTM C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
- ASTM C1602/C1602M Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- ASTM G109 Standard Test Method for Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
- ASTM C330/C330M Standard Specification for Lightweight Aggregates for Structural Concrete
- ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete

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- CAN/CSA G30.18 Carbon steel bars for concrete reinforcement
- CAN/CSA A3000 Cementitious Materials Compendium

- CAN/CSA G40.20/G40.21 General requirements for rolled or welded structural quality steel / Structural quality steel
- CAN/CSA A23.1/A23.2 Concrete Materials and Methods of Concrete Construction/Test methods and Standard Practices for Concrete
- CAN/CSA A23.4 Precast concrete - Materials and construction
- CSA S806 Design and construction of building structures with fiber-reinforced polymers

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- ISO 6707-1: 2014 Buildings and Civil Engineering Works - Vocabulary - Part 1: General Terms
- ISO 14021:1999 Environmental Labels and Declarations - Self-declared Environmental Claims (Type II Environmental Labeling)
- ISO 14025:2006 Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures
- ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines
- ISO 14067:2018 Greenhouse Gases - Carbon Footprint of Products - Requirements and Guidelines for Quantification
- ISO 14050:2009 Environmental Management - Vocabulary
- ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products

EN Standards:

- EN 16757 Sustainability of construction works - Environmental product declarations - Product Category Rules for concrete and concrete elements
- EN 15804 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

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