Environmental Product Declaration

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

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)
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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 50 concrete mixes manufactured at the Holcim Mexico Operaciones S.A. de C.V. Queretaro 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	0.04 MPa 28d strength Ready mix concrete	Ready mix concrete	0.04	0.4473198
2	3750NB2018	0.05 MPa 28d strength Ready mix concrete	Ready mix concrete	0.05	0.5601751
3	24005NB0520	0.49 MPa 28d strength Fluid Fill	Fluid Fill	0.49	11.0712150
4	24007NB0520	0.69 MPa 28d strength Fluid Fill	Fluid Fill	0.69	7.0665610
5	24010NB0520	0.98 MPa 28d strength Fluid Fill	Fluid Fill	0.98	5.1453314
6	24015NB0520	1.47 MPa 28d strength Fluid Fill	Fluid Fill	1.47	4.0293419
7	24020NB0520	1.96 MPa 28d strength Fluid Fill	Fluid Fill	1.96	3.3043069
8	24025NB0518	2.45 MPa 28d strength Fluid Fill	Fluid Fill	2.45	2.8463772
9	24030NB0520	2.94 MPa 28d strength Fluid Fill	Fluid Fill	2.94	2.4555775
10	77035ND2014	3.43 MPa 28d strength Ready mix concrete	Ready mix concrete	3.43	0.9079630

11	24035NB0520	3.43 MPa 28d strength Fluid Fill	Fluid Fill	3.43	2.1930539
12	77036ND4010	3.53 MPa 28d strength Ready mix concrete	Ready mix concrete	3.53	0.8558133
13	77038ND4010	3.73 MPa 28d strength Ready mix concrete	Ready mix concrete	3.73	0.8153298
14	77040ND2014	3.92 MPa 28d strength Ready mix concrete	Ready mix concrete	3.92	0.8815592
15	24040NB0520	3.92 MPa 28d strength Fluid Fill	Fluid Fill	3.92	1.9904975
16	77042NB2014	4.12 MPa 28d strength Ready mix concrete	Ready mix concrete	4.12	0.7803302
17	60042ND1210	4.12 MPa 28d strength special concrete	special concrete	4.12	0.7336957
18	39045ND2006	4.41 MPa 28d strength Ready mix concrete	Ready mix concrete	4.41	0.6577055
19	77048ND2014	4.71 MPa 28d strength Ready mix concrete	Ready mix concrete	4.71	0.7111232
20	39050ND4006	4.9 MPa 28d strength Ready mix concrete	Ready mix concrete	4.90	0.6059770
21	68050NB0514	4.9 MPa 28d strength special concrete	special concrete	4.90	1.7590519
22	24050NB0518	4.9 MPa 28d strength Fluid Fill	Fluid Fill	4.90	1.7590519
23	24060NB0518	5.88 MPa 28d strength Fluid Fill	Fluid Fill	5.88	1.7000000
24	60075NB0518	7.36 MPa 28d strength special concrete	special concrete	7.36	1.4652174
25	24075NB0518	7.36 MPa 28d strength Fluid Fill	Fluid Fill	7.36	1.4377332
26	01100NB2018	9.81 MPa 28d strength Ready mix concrete	Ready mix concrete	9.81	1.4575794
27	76100NB1218	9.81 MPa 28d strength special concrete	special concrete	9.81	0.8241758
28	73100NB0514	9.81 MPa 28d strength mortar	mortar	9.81	1.6771513
29	60120NB2018	11.77 MPa 28d strength special concrete	special concrete	11.77	0.5660377
30	01150NB2018	14.71 MPa 28d strength Ready mix concrete	Ready mix concrete	14.71	1.2316831
31	40150NB1214	14.71 MPa 28d strength Special concrete	Special concrete	14.71	0.9592341
32	73150NB0514	14.71 MPa 28d strength mortar	mortar	14.71	1.2304952

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

33	70175NB2018	17.16 MPa 28d strength Ready mix concrete	Ready mix concrete	17.16	1.1501815
34	01200NB2018	19.61 MPa 28d strength Ready mix concrete	Ready mix concrete	19.61	1.0564728
35	27200NB0500	19.61 MPa 28d strength special concrete	special concrete	19.61	0.0000000
36	11200NB0514	19.61 MPa 28d strength mortar	mortar	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
37	70210NB2018	20.59 MPa 28d strength Ready mix concrete	Ready mix concrete	20.59	0.2689471
38	07250NB1212	24.52 MPa 28d strength Ready mix concrete	Ready mix concrete	24.52	1.0179580
39	40250NB1210	24.52 MPa 28d strength special concrete	special concrete	24.52	0.7624489

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
40	07300ND1210	29.42 MPa 28d strength Ready mix concrete	Ready mix concrete	29.42	0.8720183
41	40300NB1014	29.42 MPa 28d strength special concrete	special concrete	29.42	0.7009250

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
42	60316NB2014	30.99 MPa 28d strength special concrete	special concrete	30.99	0.5780220
43	70320ND2010	31.38 MPa 28d strength Ready mix concrete	Ready mix concrete	31.38	0.7727735
44	01350NB2018	34.32 MPa 28d strength Ready mix concrete	Ready mix concrete	34.32	0.7408041
45	60350NB1010	34.32 MPa 28d strength special concrete	special concrete	34.32	0.6421086

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
46	70400NB2014	39.23 MPa 28d strength Ready mix concrete	Ready mix concrete	39.23	0.6628941

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
47	13450NB2018	44.13 MPa 28d strength Ready mix concrete	Ready mix concrete	44.13	0.5169290
48	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
49	13550NB2018	53.94 MPa 28d strength Ready mix concrete	Ready mix concrete	53.94	0.4428571
50	60550NB2022	53.94 MPa 28d strength special concrete	special concrete	53.94	0.6355140

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:

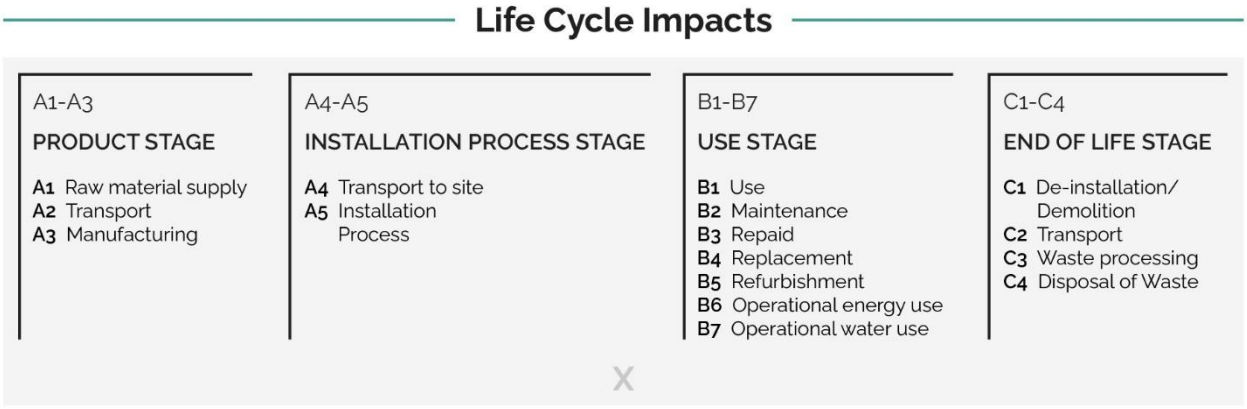
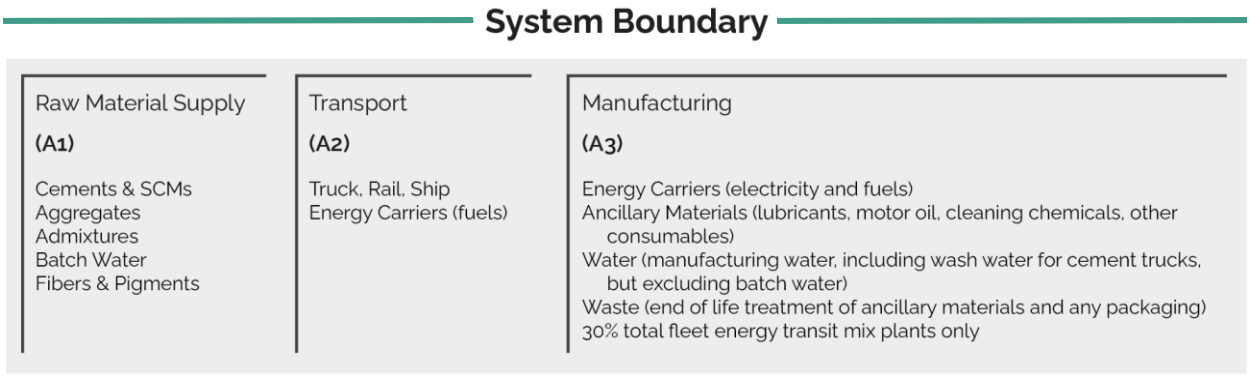


Figure 1: **General life cycle phases for consideration in a construction works system**

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

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

- 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.

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 Queretaro 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 biological treatment/tap water/RoW/kg	ecoinvent v3.8	Queretaro	v3.8 in 2021	2	3	1	3	3
Gravel	limestone quarry operation/limestone, unprocessed/RoW/kg;	ecoinvent v3.8	Queretaro	v3.8 in 2021	2	3	1	3	3

	Note: modifications made (see ecoinvent activity changes table)								
Additives	market for chemical, organic/chemical, organic/GLO/kg	ecoinvent v3.8	Mexico	v3.8 in 2021	2	3	1	3	3
Cement (CPC 40) - SUPPLIER: Cementos Apaxco S.A. de C.V. (Apaxco Plant)	CPC 40	Progam Operator: Labeling Sustainability-EPD ID: e38f688d-1fa5-41b0-a9b1-e5b1422ea654	Estado de México	very good, 3rd party verfied facility-specific EPD dataset	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	50.2	0.107	77.1	4.35e-06	1.12	0.000221	429
Maximum	610	0.716	581	1.76e-05	14.4	0.00211	1600
Mean	287	0.366	292	1.02e-05	6.75	0.00103	952
Median	289	0.366	288	1.03e-05	6.8	0.001	952
3740NB2014	610	0.716	581	1.76e-05	14.4	0.00211	1600
3750NB2018	518	0.618	505	1.66e-05	12.2	0.00187	1600
24005NB0520	50.2	0.107	77.1	4.35e-06	1.12	0.000221	429
24007NB0520	72.3	0.131	96.6	4.74e-06	1.65	0.000293	468
24010NB0520	94.4	0.155	116	5.1e-06	2.18	0.000364	501
24015NB0520	117	0.179	135	5.5e-06	2.7	0.000436	540
24020NB0520	139	0.203	155	5.87e-06	3.23	0.000507	575
24025NB0518	170	0.237	182	6.44e-06	3.96	0.00061	634
24030NB0520	183	0.251	194	6.65e-06	4.28	0.00065	649
77035ND2014	313	0.395	321	1.26e-05	7.34	0.00115	1120
24035NB0520	205	0.275	213	7e-06	4.81	0.000721	683
77036ND4010	308	0.39	319	1.3e-05	7.21	0.00114	1140
77038ND4010	327	0.411	336	1.35e-05	7.66	0.00122	1220
77040ND2014	344	0.429	347	1.28e-05	8.09	0.00125	1150
24040NB0520	227	0.299	232	7.34e-06	5.33	0.00079	714
77042NB2014	363	0.45	365	1.33e-05	8.54	0.00131	1190
60042ND1210	419	0.509	412	1.4e-05	9.87	0.00148	1250
39045ND2006	396	0.486	396	1.45e-05	9.31	0.00144	1320
77048ND2014	399	0.488	396	1.4e-05	9.39	0.00143	1250
39050ND4006	422	0.514	420	1.52e-05	9.93	0.00153	1380
68050NB0514	263	0.338	264	7.94e-06	6.19	0.000909	778
24050NB0518	263	0.338	264	7.94e-06	6.19	0.000909	778

24060NB0518	286	0.363	285	8.49e-06	6.74	0.000991	842
60075NB0518	264	0.341	270	9.71e-06	6.21	0.00095	879
24075NB0518	289	0.365	287	8.54e-06	6.79	0.000995	840
01100NB2018	213	0.288	235	1.09e-05	4.97	0.000847	1000
76100NB1218	412	0.499	396	1.12e-05	9.72	0.00141	1060
73100NB0514	289	0.366	288	8.53e-06	6.81	0.00101	866
60120NB2018	303	0.384	308	1.17e-05	7.12	0.0011	992
01150NB2018	246	0.323	262	1.13e-05	5.75	0.000932	996
40150NB1214	361	0.445	358	1.18e-05	8.49	0.00128	1120
73150NB0514	333	0.413	326	9.27e-06	7.85	0.00114	912

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	467	12.2	454	13.3	0.000786	0.536	41.8	0.000837	0.158	1.47e-05	0.0884	30.1
Maximum	1820	101	1700	49.2	0.00791	0.989	88.6	0.00333	0.446	1.47e-05	0.0884	30.1
Mean	1070	49.2	1010	29.3	0.00384	0.725	62.8	0.00194	0.336	1.47e-05	0.0884	30.1
Median	1070	49.8	1010	29.4	0.00392	0.728	63.6	0.00197	0.336	1.47e-05	0.0884	30.1
3740NB2014	1820	101	1700	49.2	0.00791	0.989	88.6	0.00333	0.254	1.47e-05	0.0884	30.1
3750NB2018	1800	87.8	1700	48.4	0.00683	0.915	84.4	0.0031	0.269	1.47e-05	0.0884	30.1
24005NB0520	467	12.2	454	13.3	0.000786	0.558	41.8	0.000837	0.428	1.47e-05	0.0884	30.1
24007NB0520	513	15.8	493	14.6	0.00106	0.577	43.1	0.00091	0.421	1.47e-05	0.0884	30.1
24010NB0520	551	19.6	530	15.7	0.00139	0.594	44.2	0.000977	0.415	1.47e-05	0.0884	30.1
24015NB0520	598	23.4	575	17	0.00165	0.614	45.4	0.00105	0.41	1.47e-05	0.0884	30.1
24020NB0520	640	26.9	613	18	0.00195	0.634	46.6	0.00112	0.405	1.47e-05	0.0884	30.1
24025NB0518	706	32.1	674	19.9	0.00235	0.697	48.3	0.00122	0.432	1.47e-05	0.0884	30.1
24030NB0520	725	34.3	696	20.5	0.00253	0.683	49.1	0.00126	0.404	1.47e-05	0.0884	30.1
77035ND2014	1240	50.8	1190	33.7	0.00417	0.675	73	0.00241	0.259	1.47e-05	0.0884	30.1
24035NB0520	766	37.9	727	21.7	0.0028	0.71	50.2	0.00133	0.407	1.47e-05	0.0884	30.1
77036ND4010	1270	48.9	1220	34.4	0.00414	0.65	74.9	0.00249	0.239	1.47e-05	0.0884	30.1

77038ND4010	1350	52.7	1300	36.5	0.00434	0.676	76.1	0.00257	0.243	1.47e-05	0.0884	30.1
77040ND2014	1280	56.1	1220	34.8	0.00458	0.727	73.4	0.00245	0.278	1.47e-05	0.0884	30.1
24040NB0520	805	41.4	760	22.7	0.00301	0.738	51.3	0.00139	0.411	1.47e-05	0.0884	30.1
77042NB2014	1330	58.3	1260	36	0.00486	0.73	75	0.00254	0.26	1.47e-05	0.0884	30.1
60042ND1210	1410	67.4	1330	38.3	0.00537	0.812	77.3	0.00267	0.284	1.47e-05	0.0884	30.1
39045ND2006	1480	64.7	1420	40	0.00527	0.747	78.8	0.00274	0.239	1.47e-05	0.0884	30.1
77048ND2014	1400	65.4	1330	38.1	0.00518	0.769	77.5	0.00267	0.261	1.47e-05	0.0884	30.1
39050ND4006	1540	69.1	1470	41.6	0.00564	0.771	81.5	0.00288	0.235	1.47e-05	0.0884	30.1
68050NB0514	884	48	831	24.6	0.00341	0.791	53.1	0.0015	0.424	1.47e-05	0.0884	30.1
24050NB0518	879	47	827	24.6	0.00346	0.791	53.1	0.0015	0.424	1.47e-05	0.0884	30.1
24060NB0518	955	51.2	902	26.6	0.0039	0.842	54.6	0.0016	0.446	1.47e-05	0.0884	30.1
60075NB0518	985	44.8	936	26.9	0.00353	0.712	62.2	0.00186	0.354	1.47e-05	0.0884	30.1
24075NB0518	950	52.5	898	26.6	0.00387	0.776	54.8	0.00161	0.38	1.47e-05	0.0884	30.1
01100NB2018	1110	35.6	1060	29.7	0.00291	0.588	67.3	0.00208	0.277	1.47e-05	0.0884	30.1
76100NB1218	1210	69.4	1130	33.2	0.00542	0.832	65.1	0.00211	0.315	1.47e-05	0.0884	30.1
73100NB0514	978	52.8	927	27.3	0.00394	0.844	54.5	0.0016	0.445	1.47e-05	0.0884	30.1
60120NB2018	1110	46.5	1050	29.7	0.00401	0.536	72.1	0.00226	0.158	1.47e-05	0.0884	30.1
01150NB2018	1100	40	1060	29.8	0.00336	0.615	69	0.00217	0.273	1.47e-05	0.0884	30.1
40150NB1214	1270	62.9	1200	34.6	0.00488	0.794	67.1	0.00222	0.318	1.47e-05	0.0884	30.1
73150NB0514	1040	59.5	974	29.1	0.00451	0.821	57	0.00175	0.377	1.47e-05	0.0884	30.1

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	256	0.335	273	9.68e-06	5.99	0.000983	941
Maximum	383	0.468	370	1.22e-05	9.05	0.00129	1120
Mean	325	0.407	326	1.1e-05	7.65	0.00115	1020
Median	331	0.412	330	1.11e-05	7.78	0.00117	1010
70175NB2018	256	0.335	273	1.18e-05	5.99	0.000983	1060
01200NB2018	282	0.362	295	1.22e-05	6.6	0.00107	1120
27200NB0500	383	0.468	370	1.04e-05	9.05	0.00127	941
11200NB0514	380	0.463	365	9.68e-06	8.97	0.00129	959

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	1080	41.7	1010	30.6	0.00354	0.484	58.4	0.00183	0	1.47e-05	0.0884	30.1
Maximum	1240	66.1	1190	33.3	0.0051	0.82	71.2	0.00231	0.333	1.47e-05	0.0884	30.1
Mean	1150	54.9	1090	31.5	0.00438	0.645	65.2	0.0021	0.217	1.47e-05	0.0884	30.1
Median	1140	55.8	1080	31.1	0.00444	0.639	65.6	0.00212	0.268	1.47e-05	0.0884	30.1
70175NB2018	1180	41.7	1130	31.6	0.00354	0.622	70.3	0.00225	0.266	1.47e-05	0.0884	30.1
01200NB2018	1240	46.7	1190	33.3	0.00383	0.655	71.2	0.00231	0.27	1.47e-05	0.0884	30.1
27200NB0500	1080	65	1010	30.6	0.00505	0.484	60.9	0.00199	0	1.47e-05	0.0884	30.1
11200NB0514	1090	66.1	1030	30.6	0.0051	0.82	58.4	0.00183	0.333	1.47e-05	0.0884	30.1

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	318	0.4	324	1.22e-05	7.46	0.00117	1120
Maximum	1050	1.19	972	2.6e-05	24.9	0.00357	2470
Mean	591	0.695	564	1.69e-05	14	0.00205	1580
Median	406	0.495	397	1.26e-05	9.58	0.00142	1160
70210NB2018	1050	1.19	972	2.6e-05	24.9	0.00357	2470
07250NB1212	318	0.4	324	1.22e-05	7.46	0.00117	1120
40250NB1210	406	0.495	397	1.26e-05	9.58	0.00142	1160

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	1250	52.1	1190	33.8	0.00419	0.718	70.4	0.00232	0.264	1.47e-05	0.0884	30.1
Maximum	2840	179	2640	77.4	0.0133	1.5	112	0.00488	0.295	1.47e-05	0.0884	30.1
Mean	1800	99.7	1690	49.1	0.00763	1.01	84.5	0.00319	0.282	1.47e-05	0.0884	30.1
Median	1310	68	1240	36.1	0.0054	0.806	71	0.00238	0.286	1.47e-05	0.0884	30.1
70210NB2018	2840	179	2640	77.4	0.0133	1.5	112	0.00488	0.264	1.47e-05	0.0884	30.1
07250NB1212	1250	52.1	1190	33.8	0.00419	0.718	71	0.00232	0.295	1.47e-05	0.0884	30.1
40250NB1210	1310	68	1240	36.1	0.0054	0.806	70.4	0.00238	0.286	1.47e-05	0.0884	30.1

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	354	0.44	356	1.28e-05	8.34	0.00128	1150
Maximum	465	0.558	448	1.33e-05	11	0.0016	1240
Mean	410	0.499	402	1.3e-05	9.67	0.00144	1200
Median	410	0.499	402	1.3e-05	9.67	0.00144	1200
07300ND1210	354	0.44	356	1.28e-05	8.34	0.00128	1150
40300NB1014	465	0.558	448	1.33e-05	11	0.0016	1240

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	1280	57.2	1220	34.9	0.00483	0.744	72.4	0.00245	0.284	1.47e-05	0.0884	30.1
Maximum	1410	77.8	1330	38.7	0.00617	0.886	73.4	0.00252	0.302	1.47e-05	0.0884	30.1
Mean	1340	67.5	1280	36.8	0.0055	0.815	72.9	0.00249	0.293	1.47e-05	0.0884	30.1
Median	1340	67.5	1280	36.8	0.0055	0.815	72.9	0.00249	0.293	1.47e-05	0.0884	30.1
07300ND1210	1280	57.2	1220	34.9	0.00483	0.744	73.4	0.00245	0.284	1.47e-05	0.0884	30.1
40300NB1014	1410	77.8	1330	38.7	0.00617	0.886	72.4	0.00252	0.302	1.47e-05	0.0884	30.1

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	339	0.424	345	1.33e-05	7.97	0.00124	1180
Maximum	514	0.613	496	1.56e-05	12.1	0.00179	1400

Mean	440	0.533	432	1.44e-05	10.4	0.00156	1300
Median	454	0.548	442	1.43e-05	10.7	0.0016	1320
60316NB2014	514	0.613	496	1.56e-05	12.1	0.00179	1400
70320ND2010	339	0.424	345	1.33e-05	7.97	0.00124	1180
01350NB2018	407	0.497	403	1.41e-05	9.57	0.00146	1290
60350NB1010	502	0.598	482	1.45e-05	11.9	0.00174	1340

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	1310	54.7	1250	35.5	0.00439	0.682	75.9	0.00255	0.24	1.47e-05	0.0884	30.1
Maximum	1580	82.9	1490	43	0.00672	0.919	83	0.00298	0.299	1.47e-05	0.0884	30.1
Mean	1460	71.8	1390	39.8	0.00577	0.824	78.4	0.00274	0.273	1.47e-05	0.0884	30.1
Median	1480	74.9	1400	40.3	0.00599	0.848	77.4	0.00272	0.276	1.47e-05	0.0884	30.1
60316NB2014	1580	82.9	1490	43	0.00672	0.902	83	0.00298	0.276	1.47e-05	0.0884	30.1
70320ND2010	1310	54.7	1250	35.5	0.00439	0.682	75.9	0.00255	0.24	1.47e-05	0.0884	30.1
01350NB2018	1450	67.7	1380	39.1	0.00542	0.795	77.5	0.00268	0.277	1.47e-05	0.0884	30.1
60350NB1010	1510	82.1	1430	41.5	0.00655	0.919	77.4	0.00275	0.299	1.47e-05	0.0884	30.1

Mix designs: 36 to 40 MPa

Table 16: **Total life cycle (across modules in scope) impact results for Mix designs: 36 to 40MPa, 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	422	0.514	417	1.44e-05	9.95	0.00151	1290
Maximum	422	0.514	417	1.44e-05	9.95	0.00151	1290
Mean	422	0.514	417	1.44e-05	9.95	0.00151	1290
Median	422	0.514	417	1.44e-05	9.95	0.00151	1290
70400NB2014	422	0.514	417	1.44e-05	9.95	0.00151	1290

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	1440	69.5	1380	39.2	0.00547	0.79	79.1	0.00275	0.258	1.47e-05	0.0884	30.1
Maximum	1440	69.5	1380	39.2	0.00547	0.79	79.1	0.00275	0.258	1.47e-05	0.0884	30.1
Mean	1440	69.5	1380	39.2	0.00547	0.79	79.1	0.00275	0.258	1.47e-05	0.0884	30.1
Median	1440	69.5	1380	39.2	0.00547	0.79	79.1	0.00275	0.258	1.47e-05	0.0884	30.1
70400NB2014	1440	69.5	1380	39.2	0.00547	0.79	79.1	0.00275	0.258	1.47e-05	0.0884	30.1

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	499	0.597	485	1.6e-05	11.8	0.00175	1420
Maximum	510	0.609	494	1.62e-05	12	0.00179	1430
Mean	504	0.603	490	1.61e-05	11.9	0.00177	1420
Median	504	0.603	490	1.61e-05	11.9	0.00177	1420
13450NB2018	510	0.609	494	1.62e-05	12	0.00179	1430
60450NB2022	499	0.597	485	1.6e-05	11.8	0.00175	1420

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	1600	81	1510	43.5	0.00658	0.861	84.6	0.00306	0.244	1.47e-05	0.0884	30.1
Maximum	1610	83.5	1530	43.9	0.00672	0.87	84.9	0.00308	0.247	1.47e-05	0.0884	30.1
Mean	1600	82.2	1520	43.7	0.00665	0.865	84.8	0.00307	0.246	1.47e-05	0.0884	30.1

Median	1600	82.2	1520	43.7	0.00665	0.865	84.8	0.00307	0.246	1.47e-05	0.0884	30.1
13450NB2018	1610	83.5	1530	43.9	0.00672	0.87	84.9	0.00308	0.244	1.47e-05	0.0884	30.1
60450NB2022	1600	81	1510	43.5	0.00658	0.861	84.6	0.00306	0.247	1.47e-05	0.0884	30.1

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	593	0.697	566	1.74e-05	14	0.00205	1550
Maximum	604	0.709	576	1.76e-05	14.3	0.00208	1570
Mean	598	0.703	571	1.75e-05	14.2	0.00206	1560
Median	598	0.703	571	1.75e-05	14.2	0.00206	1560
13550NB2018	593	0.697	566	1.74e-05	14	0.00205	1550
60550NB2022	604	0.709	576	1.76e-05	14.3	0.00208	1570

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	1750	96.3	1650	47.7	0.00771	0.957	88.8	0.00332	0.244	1.47e-05	0.0884	30.1
Maximum	1770	98	1670	48.3	0.00783	1.09	89.4	0.00336	0.357	1.47e-05	0.0884	30.1
Mean	1760	97.2	1660	48	0.00777	1.02	89.1	0.00334	0.3	1.47e-05	0.0884	30.1
Median	1760	97.2	1660	48	0.00777	1.02	89.1	0.00334	0.3	1.47e-05	0.0884	30.1
13550NB2018	1750	96.3	1650	47.7	0.00771	0.957	88.8	0.00332	0.244	1.47e-05	0.0884	30.1
60550NB2022	1770	98	1670	48.3	0.00783	1.09	89.4	0.00336	0.357	1.47e-05	0.0884	30.1

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

CSA Standards:

- CAN/CGSB-1.40 Anticorrosive Structural Steel Alkyd Primer
- 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

ISO Standards:

- 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

Other References:

- US EPA Waste Reduction Model (WARM), Fly Ash Chapter: http://epa.gov/climatechange/wycd/waste/downloads/fly-ash-chapter10-28-10.pdf
- American Concrete Institute (ACI) 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- ACI 318-14 Building Code Requirements for Structural Concrete and Commentary. American Concrete Institute. Farmington Hills, MI, USA available at https://www.concrete.org/store/
- Mather, B & Ozyildirim, C. (2002). SP-1(02) : Concrete Primer. American Concrete Institute: SP0102. American Concrete Institute. Farmington Hills, MI, USA available at https://www.concrete.org/store/
- NSF International (February 2019). Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) of Concrete v1.2.
- Product Category Rules for Preparing an Environmental Product Declaration for Precast Concrete (UN CPC 37550), ASTM International, March 2015. https://www.astm.org/CERTIFICATION/DOCS/266.PCR_for_Precast_Concrete.pdf
- USGBC LEED v4 for Building Design and Construction, 11 Jan 2019 available at https://www.usgbc.org/resources/pcr-committee-process-resources-part-b
- USGBC PCR Committee Process & Resources: Part B, USGBC, 7 July 2017 available at https://www.usgbc.org/resources/pcr-committee-process-resources-part-b.