ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT KM25 HACHADURA** facility in Ahuachapán, El Salvador.

HOLCIM

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers concrete products produced by Holcim Nicaragua. Declared unit: 1 m3 of concrete
Declaration Owner:	Holcim El Salvador S/N Calle Holcim y Av. El Espino, Madre Selva Antiguo Cuascatlán, El Salvador www.holcim.com.sv
Program Operator:	Labeling Sustainability Address, 11670 W Sunset Blvd. City, State, 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.
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:	13 June 2023
Period of Validity:	5 years; valid until 13 June 2028
EPD Number:	2698e6f4-5380-4ac8-9150-71be53feab57

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COMPANY DESCRIPTION

Holcim El Salvador as part of the Holcim Group, a world leader in innovative and sustainable solutions for construction, is making it possible to have greener cities, smarter infrastructures and improve the standard of living of people around the world. With sustainability at the core of its strategy, Holcim is becoming a Net Zero company, where its people and communities are the foundation of its success. The company is driving circular construction as a world leader in recycling to build more with less. Holcim El Salvador produces and markets cement and ready-mix concrete, as well as other products and solutions for construction. In El Salvador, the company has more than 500 people who are passionate about building progress for people and the planet. It has a nationwide presence through 2 cement plants with a current installed capacity to produce 1.9 million tons of cement per year, 6 fixed ready-mix concrete plants, corporate offices, 1 Geocycle platform, 1 aggregates plant, 1 Distribution Center Disensa, hundreds of Disensa points of sale throughout the country and the Holcim Foundation.

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 El Salvador 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 El Salvador 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 El Salvador's license to operate in the community. The intended audience for this LCA report is Holcim El Salvador'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 149 concrete mixes manufactured at the Holcim El Salvador KM 25 concrete facility in Metapan, El Salvador

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 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	100 BOMBA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.7000
2	100 BOMBA CON TEMPERATURA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.7000
3	100 BOMBA CON RETARDANTE ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.7000
4	100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.7000
5	100 BOMBA CON FIBRA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6923
6	100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6923
7	100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6923
8	100 DIRECTO ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6800
9	100 DIRECTO CON TEMPERATURA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6800
10	100 DIRECTO CON RETARDANTE ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6538
11	100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6538

12	100 DIRECTO CON FIBRA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6923
13	100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6731
14	100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	10 MPa 28d strength ready mix concrete.	Ready Mix	10	0.6923
15	140 DIRECTO ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6140
16	140 DIRECTO CON RETARDANTE ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6140
17	140 DIRECTO CON TEMPERATURA ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6140
18	140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6140
19	140 BOMBA ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6316
20	140 BOMBA CON RETARDANTE ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6316
21	140 BOMBA CON TEMPERATURA ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6316
22	140 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	14 MPa 28d strength ready mix concrete.	Ready Mix	14	0.6316

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
23	180 BOMBA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5833
24	180 BOMBA CON TEMPERATURA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5833
25	180 BOMBA CON RETARDANTE ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5833
26	180 BOMBA CON RETARDANTE Y	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5833

	TEMPERATURA ECOPACT				
27	180 BOMBA CON FIBRA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5806
28	180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5806
29	180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5806
30	180 DIRECTO ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5667
31	180 DIRECTO CON TEMPERATURA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5667
32	180 DIRECTO CON RETARDANTE ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5574
33	180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5574
34	180 DIRECTO CON FIBRA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5806
35	180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5806
36	180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	18 MPa 28d strength ready mix concrete.	Ready Mix	18	0.5806

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	210 DIRECTO ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4722
38	210 DIRECTO CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4722
39	210 DIRECTO CON RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4722
40	210 DIRECTO CON RETARDANTE Y	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4722

	TEMPERATURA ECOPACT				
41	210 DIRECTO CON FIBRA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4865
42	210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4865
43	210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4865
44	210 BOMBA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
45	210 BOMBA CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
46	210 BOMBA CON RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5143
47	210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5143
48	210 BOMBA CON FIBRA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
49	210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
50	210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
51	210 BOMBA PP ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
52	210 BOMBA PP CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5000
53	210 SEMIFLUIDO ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4800
54	210 SEMIFLUIDO CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4800
55	210 SEMIFLUIDO CON RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4800
56	210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4800

57	210 SEMIFLUIDO CON FIBRA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5067
58	210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5067
59	210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.5067
60	210 SEMIFLUIDO 3/8 ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4634
61	210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4578
62	210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4634
63	210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4578
64	210 FLUIDO ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4868
65	210 FLUIDO CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4868
66	210 FLUIDO CON RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4868
67	210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4868
68	210 FLUIDO CON FIBRA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4805
69	210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4805
70	210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4805
71	210 FLUIDO 3/8 ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4588
72	210 FLUIDO 3/8 CON RETARDANTE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4588

73	210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4588
74	210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4588
75	210 LANZADO ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4070
76	210 LANZADO CON TEMPERATURA ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.4070
77	210 PERMEABLE ECOPACT	21 MPa 28d strength ready mix concrete.	Ready Mix	21	0.2041
78	245 DIRECTO ECOPACT	24 MPa 28d strength ready mix concrete.	Ready Mix	24	0.4605
79	245 BOMBA ECOPACT	24 MPa 28d strength ready mix concrete.	Ready Mix	24	0.4675
80	250 DIRECTO ECOPACT	25 MPa 28d strength ready mix concrete.	Ready Mix	25	0.4605
81	250 BOMBA ECOPACT	25 MPa 28d strength ready mix concrete.	Ready Mix	25	0.4675

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
82	280 DIRECTO ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4217
83	280 DIRECTO CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4217
84	280 DIRECTO CON RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4217
85	280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4217
86	280 DIRECTO CON FIBRA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4286
87	280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4286
88	280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4286

89	280 BOMBA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4368
90	280 BOMBA CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4368
91	280 BOMBA CON RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4253
92	280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4253
93	280 BOMBA CON FIBRA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
94	280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
95	280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
96	280 BOMBA PP ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4368
97	280 BOMBA PP CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4368
98	280 SEMIFLUIDO ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
99	280 SEMIFLUIDO CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
100	280 SEMIFLUIDO CON RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
101	280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4318
102	280 SEMIFLUIDO CON FIBRA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4382
103	280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4382
104	280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4382
105	280 SEMIFLUIDO 3/8 ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4043

106	280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4000
107	280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4043
108	280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4000
109	280 FLUIDO ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4222
110	280 FLUIDO CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4222
111	280 FLUIDO CON RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4176
112	280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4176
113	280 FLUIDO CON FIBRA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4286
114	280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4286
115	280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.4286
116	280 FLUIDO 3/8 ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.3878
117	280 FLUIDO 3/8 CON RETARDANTE ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.3878
118	280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.3878
119	280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.3878
120	280 LANZADO ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.3838
121	280 LANZADO CON TEMPERATURA ECOPACT	27 MPa 28d strength ready mix concrete.	Ready Mix	27	0.3838

122	300 BOMBA ECOPACT	29 MPa 28d strength ready mix concrete.	Ready Mix	29	0.3619
123	300 BOMBA CON RETARDANTE ECOPACT	29 MPa 28d strength ready mix concrete.	Ready Mix	29	0.3619
124	300 BOMBA CON TEMPERATURA ECOPACT	29 MPa 28d strength ready mix concrete.	Ready Mix	29	0.3619
125	300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	29 MPa 28d strength ready mix concrete.	Ready Mix	29	0.3619

Mix designs: 31 to 35 MPa:

Table 5: **Declared products with Mix designs: 31 to 35MPa considered in this environmental product declaration.**

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	H2O to cement ratio
126	350 BOMBA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3551
127	350 BOMBA CON RETARDANTE ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3551
128	350 BOMBA CON TEMPERATURA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3551
129	350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3551
130	350 SEMIFLUIDO ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3824
131	350 SEMIFLUIDO CON RETARDANTE ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3824
132	350 SEMIFLUIDO CON TEMPERATURA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3824
133	350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3824
134	350 FLUIDO ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3578
135	350 FLUIDO CON RETARDANTE ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3578
136	350 FLUIDO CON TEMPERATURA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3578

137	350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	34 MPa 28d strength ready mix concrete.	Ready Mix	34	0.3578

Mix designs: 41 to 45 MPa:

Table 6: **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
138	420 BOMBA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3762
139	420 BOMBA CON RETARDANTE ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3762
140	420 BOMBA CON TEMPERATURA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3762
141	420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3762
142	420 SEMIFLUIDO ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
143	420 SEMIFLUIDO CON RETARDANTE ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
144	420 SEMIFLUIDO CON TEMPERATURA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
145	420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
146	420 FLUIDO ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
147	420 FLUIDO CON RETARDANTE ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
148	420 FLUIDO CON TEMPERATURA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654
149	420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	41 MPa 28d strength ready mix concrete.	Ready Mix	41	0.3654

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 7: **Ready mix concrete composition**

Product Components	Raw Material, weight%
Cement	Proprietary
Aggregates	30-60.00
Others	0.01-5.00
Total	100.00

A1 RAW MATERIAL RECYCLED CONTENT AND MATERIAL LOSSES

The following table provides a list of the raw material inputs (module A1) across all products considered, their recyclability content and assumed material losses.

Table 8: **Module A1 raw material inputs, the recyclability content and assumed material losses (dry basis)**

product.name	mix.category	primary.content	post.industrial.content	post.consumer.content	material.losses
Cemento Fuerte Industrial	Cemento Fuerte Industrial	1	0	0	0
Water	tap water	1	0	0	0.05
Gravel	gravel, crushed	1	0	0	0.05
Crushed Sand	sand	1	0	0	0.05
Additives	chemical, organic	1	0	0	0.05
Acrylic Fibre	acrylic filler	1	0	0	0.05

SYSTEM BOUNDARIES

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

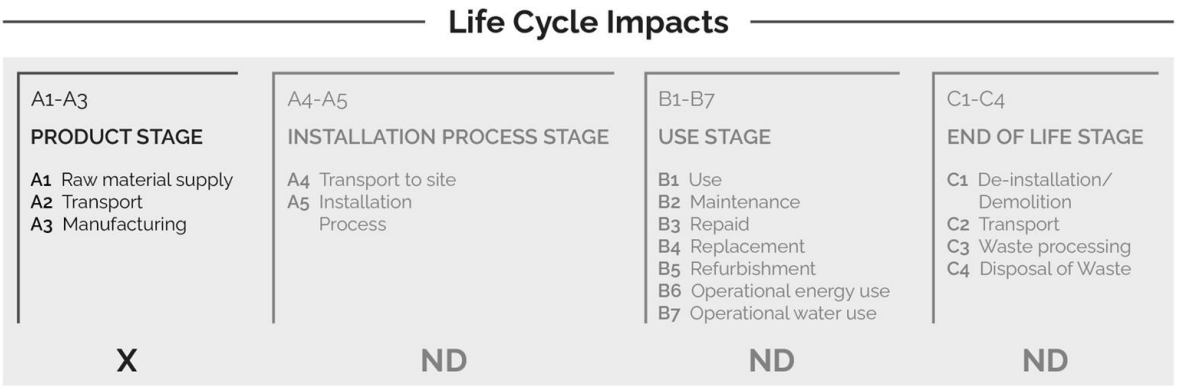

Figure 1: **General life cycle phases for consideration in a construction works system.**

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.

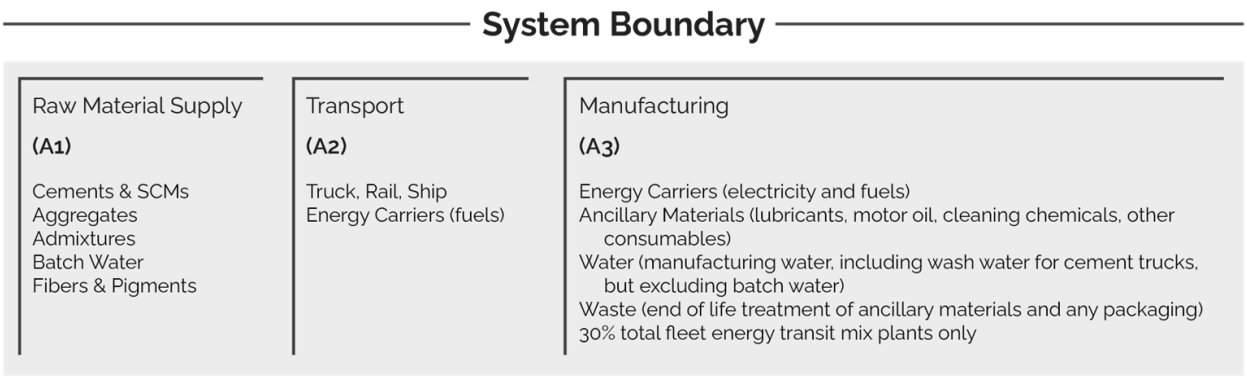

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

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 El Salvador, is located at their Planta KM 25 facility in El Salvador. All operating data is formulated using the actual data from Holcim El Salvador'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/activies stemming from the ecoinvent v3.8 database and a local EPD database in combination with primary data from Holcim El Salvador 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 El Salvador in calendar year 2021. These values were direct reported from Holcim records. The unit process "market for electricity, medium voltage/electricity, medium voltage/EC/kWh" was used to represent the El Salvador grid electricity used by the concrete plant.

Process/space heating: Not applicable.

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

Waste generation: Waste generation values are directly reported from Holcim operations for both bulk waste. No Hazardous waste High-level radioactive waste is generated on-site at this facility.

Recovered energy: Not applicable.

Recycled/reused material/components: The amount of returned concrete is based on Holcim primary data for the reference year, 2021.

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: Not applicable.

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 2021.

Product transport requirements: The diesel fuel used by the mixing trucks is direct primary information reported from Holcim El Salvador records for the year 2021. Holcim records their fuel for their trucks in l/km and therefore the information was converted with the following formula: (Ave. km to site)* 2 for return L diesel/km /(ave. m3 of concrete in a load) total concrete volume in m3 * fraction allocated to A3. A4 is outside the scope of this study.

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 9: **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
Water	tap water production, conventional with biological treatment/tap water/RoW/kg	ecoinvent v3.8	Santa Ana	v3.8 in 2021	2	3	1	3	3
Acrylic Fibre	market for acrylic filler/acrylic filler/RoW/kg	ecoinvent v3.8	San Salvador	v3.8 in 2021	2	3	1	3	3
Additives	market for chemical, organic/chemical, organic/GLO/kg	ecoinvent v3.8	Sonsonate	v3.8 in 2021	2	3	1	3	3

Cemento Fuerte Industrial	Cemento Fuerte Industrial	Progam Operator: Labeling Sustainability-EPD ID: ae8c3b6d-1972-4402-b184-115794c37a67	Santa Ana	21 July 2023	3	3	3	3	3
Crushed Sand	sand quarry operation, extraction from river bed/sand/BR/kg; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.8	La Libertad	v3.8 in 2021	2	3	1	3	3
Gravel	gravel production, crushed/gravel, crushed/BR/kg; Note: modifications made (see ecoinvent activity changes table)	ecoinvent v3.8	La Libertad	v3.8 in 2021	2	3	1	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 Cement 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 2021-01-01 to 2021-12-31.
- 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.

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 10: **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	74.2	0.128	396	4.82e-05	0.984	0.00255	6110
Maximum	82.8	0.142	441	5.28e-05	1.1	0.00285	6810
Mean	78.4	0.135	417	5.05e-05	1.04	0.0027	6440
Median	77.8	0.134	412	5.02e-05	1.04	0.00266	6360
100 BOMBA ECOPACT	74.2	0.128	396	4.82e-05	0.984	0.00255	6110
100 BOMBA CON TEMPERATURA ECOPACT	74.2	0.128	396	4.82e-05	0.984	0.00255	6110
100 BOMBA CON RETARDANTE ECOPACT	74.2	0.128	396	4.82e-05	0.984	0.00255	6110
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	74.2	0.128	396	4.82e-05	0.984	0.00255	6110
100 BOMBA CON FIBRA ECOPACT	76.5	0.132	409	4.96e-05	1.01	0.00264	6310

100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	76.5	0.132	409	4.96e-05	1.01	0.00264	6310
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	76.5	0.132	409	4.96e-05	1.01	0.00264	6310
100 DIRECTO ECOPACT	75.2	0.129	397	4.85e-05	1	0.00256	6130
100 DIRECTO CON TEMPERATURA ECOPACT	75.2	0.129	397	4.85e-05	1	0.00256	6130
100 DIRECTO CON RETARDANTE ECOPACT	77.8	0.134	412	5.02e-05	1.03	0.00266	6360
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	77.8	0.134	412	5.02e-05	1.03	0.00266	6360
100 DIRECTO CON FIBRA ECOPACT	77.9	0.134	412	5.02e-05	1.04	0.00266	6360
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	77.9	0.134	412	5.02e-05	1.04	0.00266	6360
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	77.9	0.134	412	5.02e-05	1.04	0.00266	6360
140 DIRECTO ECOPACT	82.1	0.141	438	5.24e-05	1.08	0.00284	6770
140 DIRECTO CON RETARDANTE ECOPACT	82.1	0.141	438	5.24e-05	1.08	0.00284	6770
140 DIRECTO CON TEMPERATURA ECOPACT	82.1	0.141	438	5.24e-05	1.08	0.00284	6770
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	82.1	0.141	438	5.24e-05	1.08	0.00284	6770
140 BOMBA ECOPACT	82.8	0.142	441	5.28e-05	1.1	0.00285	6810
140 BOMBA CON RETARDANTE ECOPACT	82.8	0.142	441	5.28e-05	1.1	0.00285	6810
140 BOMBA CON TEMPERATURA ECOPACT	82.8	0.142	441	5.28e-05	1.1	0.00285	6810
140 BOMBA CON RETARDANTE Y	82.8	0.142	441	5.28e-05	1.1	0.00285	6810

TEMPERATURA ECOPACT							

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	6750	178	6570	174	0.00315	10.6	74.2	0.00658	0.178	0.000452	0	0.212
Maximum	7570	203	7360	195	0.0036	12	78.8	0.00709	0.189	0.000452	0	0.212
Mean	7150	190	6950	184	0.00336	11.5	76.7	0.00684	0.185	0.000452	0	0.212
Median	7060	186	6860	182	0.00331	11.8	77.4	0.00687	0.184	0.000452	0	0.212
100 BOMBA ECOPACT	6780	179	6600	174	0.00315	12	74.2	0.00658	0.184	0.000452	0	0.212
100 BOMBA CON TEMPERATURA ECOPACT	6750	180	6570	174	0.00316	12	74.2	0.00658	0.184	0.000452	0	0.212
100 BOMBA CON RETARDANTE ECOPACT	6780	178	6590	175	0.00323	12	74.2	0.00658	0.184	0.000452	0	0.212
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	6760	178	6580	175	0.00324	12	74.2	0.00658	0.184	0.000452	0	0.212
100 BOMBA CON FIBRA ECOPACT	7000	184	6810	181	0.0033	12	75.7	0.00674	0.189	0.000452	0	0.212
100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	6990	185	6800	181	0.00331	12	75.7	0.00674	0.189	0.000452	0	0.212
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	6980	185	6810	180	0.0033	12	75.7	0.00674	0.189	0.000452	0	0.212
100 DIRECTO ECOPACT	6830	180	6620	175	0.00323	11.4	75	0.00664	0.178	0.000452	0	0.212
100 DIRECTO CON TEMPERATURA ECOPACT	6800	179	6630	175	0.00315	11.4	75	0.00664	0.178	0.000452	0	0.212

100 DIRECTO CON RETARDANTE ECOPACT	7070	186	6870	181	0.00332	11.8	77.4	0.00686	0.178	0.00452	0	0.212
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7050	185	6840	181	0.00331	11.8	77.4	0.00686	0.178	0.00452	0	0.212
100 DIRECTO CON FIBRA ECOPACT	7060	188	6860	182	0.00331	11.9	77.6	0.00688	0.189	0.00452	0	0.212
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	7040	187	6850	182	0.00332	11.9	77.6	0.00688	0.184	0.00452	0	0.212
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	7070	185	6860	182	0.00329	11.9	77.6	0.00688	0.189	0.00452	0	0.212
140 DIRECTO ECOPACT	7540	202	7330	193	0.00353	10.6	77.5	0.00699	0.184	0.00452	0	0.212
140 DIRECTO CON RETARDANTE ECOPACT	7510	202	7350	193	0.0035	10.6	77.5	0.00699	0.184	0.00452	0	0.212
140 DIRECTO CON TEMPERATURA ECOPACT	7520	202	7310	193	0.00353	10.6	77.5	0.00699	0.184	0.00452	0	0.212
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7530	202	7310	193	0.0036	10.6	77.5	0.00699	0.184	0.00452	0	0.212
140 BOMBA ECOPACT	7560	203	7340	194	0.00356	10.9	78.8	0.00709	0.189	0.00452	0	0.212
140 BOMBA CON RETARDANTE ECOPACT	7570	201	7360	195	0.00356	10.9	78.8	0.00709	0.189	0.00452	0	0.212
140 BOMBA CON TEMPERATURA ECOPACT	7540	202	7350	194	0.00358	10.9	78.8	0.00709	0.189	0.00452	0	0.212
140 BOMBA CON RETARDANTE Y	7560	202	7350	195	0.00352	10.9	78.8	0.00709	0.189	0.00452	0	0.212

TEMPERATURA ECOPACT												

Mix designs: 15 to 20 MPa

Table 11: **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	q	0.147	458	5.45e-05	1.13	0.00297	7090
Maximum	88.9	0.152	473	5.61e-05	1.17	0.00307	7310
Mean	87.4	0.15	466	5.54e-05	1.15	0.00302	7210
Median	87.7	0.15	466	5.54e-05	1.16	0.00302	7210
180 BOMBA ECOPACT	86	0.147	460	5.48e-05	1.14	0.00298	7110
180 BOMBA CON TEMPERATURA ECOPACT	86	0.147	460	5.48e-05	1.14	0.00298	7110
180 BOMBA CON RETARDANTE ECOPACT	85.9	0.147	459	5.46e-05	1.13	0.00297	7100
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	85.7	0.147	458	5.45e-05	1.13	0.00297	7090
180 BOMBA CON FIBRA ECOPACT	88	0.151	472	5.59e-05	1.16	0.00306	7300
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	88	0.151	472	5.59e-05	1.16	0.00306	7300
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	88	0.151	472	5.59e-05	1.16	0.00306	7300
180 DIRECTO ECOPACT	86.8	0.148	460	5.49e-05	1.15	0.00299	7120
180 DIRECTO CON TEMPERATURA ECOPACT	86.8	0.148	460	5.49e-05	1.15	0.00299	7120
180 DIRECTO CON RETARDANTE ECOPACT	87.7	0.15	466	5.54e-05	1.16	0.00302	7210
180 DIRECTO CON RETARDANTE Y	87.7	0.15	466	5.54e-05	1.16	0.00302	7210

TEMPERATURA ECOPACT							
180 DIRECTO CON FIBRA ECOPACT	88.9	0.152	473	5.61e-05	1.17	0.00307	7310
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	88.9	0.152	473	5.61e-05	1.17	0.00307	7310
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	88.9	0.152	473	5.61e-05	1.17	0.00307	7310

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	7850	210	7640	203	0.00366	10.2	79.9	0.00724	0.178	0.000452	0	0.212
Maximum	8110	220	7920	209	0.0039	11	82.1	0.00745	0.189	0.000452	0	0.212
Mean	8000	215	7780	206	0.00378	10.5	81.2	0.00736	0.184	0.000452	0	0.212
Median	8020	214	7770	206	0.00379	10.5	81.2	0.00737	0.184	0.000452	0	0.212
80 BOMBA ECOPACT	7880	211	7700	203	0.0037	11	80.7	0.0073	0.184	0.000452	0	0.212
180 BOMBA CON TEMPERATURA ECOPACT	7900	210	7640	203	0.00369	11	80.7	0.0073	0.184	0.000452	0	0.212
180 BOMBA CON RETARDANTE ECOPACT	7900	212	7660	203	0.00367	10.8	80.2	0.00727	0.184	0.000452	0	0.212
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7850	210	7670	203	0.00366	10.6	79.9	0.00724	0.184	0.000452	0	0.212
180 BOMBA CON FIBRA ECOPACT	8090	217	7860	209	0.00381	10.7	81.4	0.0074	0.189	0.000452	0	0.212
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	8090	219	7870	209	0.0038	10.7	81.4	0.0074	0.189	0.000452	0	0.212

180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	8100	216	7870	209	0.00385	10.7	81.4	0.0074	0.189	0.000452	0	0.212
180 DIRECTO ECOPACT	7900	211	7680	204	0.00373	10.4	81	0.00733	0.178	0.000452	0	0.212
180 DIRECTO CON TEMPERATURA ECOPACT	7900	213	7690	204	0.00379	10.4	81	0.00733	0.178	0.000452	0	0.212
180 DIRECTO CON RETARDANTE ECOPACT	8020	215	7780	207	0.00377	10.2	81.2	0.00737	0.178	0.000452	0	0.212
180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	8030	214	7760	206	0.00379	10.2	81.2	0.00737	0.178	0.000452	0	0.212
180 DIRECTO CON FIBRA ECOPACT	8110	220	7920	209	0.0039	10.3	82.1	0.00745	0.189	0.000452	0	0.212
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	8100	220	7910	209	0.0039	10.3	82.1	0.00745	0.189	0.000452	0	0.212
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	8110	220	7870	209	0.00387	10.3	82.1	0.00745	0.189	0.000452	0	0.212

Mix designs: 21 to 25 MPa

Table 12: **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	96.4	0.165	521	6.09e-05	1.27	0.00339	8070
Maximum	131	0.22	691	7.71e-05	1.71	0.00456	10700
Mean	103	0.177	563	6.51e-05	1.35	0.00367	8730
Median	102	0.175	554	6.43e-05	1.34	0.00361	8580
210 DIRECTO ECOPACT	100	0.171	536	6.25e-05	1.32	0.00349	8290

210 DIRECTO CON TEMPERATURA ECOPACT	100	0.171	536	6.25e-05	1.32	0.00349	8290
210 DIRECTO CON RETARDANTE ECOPACT	100	0.171	536	6.25e-05	1.32	0.00349	8290
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	100	0.171	536	6.25e-05	1.32	0.00349	8290
210 DIRECTO CON FIBRA ECOPACT	102	0.174	548	6.36e-05	1.34	0.00358	8490
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	102	0.174	548	6.36e-05	1.34	0.00358	8490
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	102	0.174	548	6.36e-05	1.34	0.00358	8490
210 BOMBA ECOPACT	97.1	0.166	522	6.1e-05	1.28	0.0034	8080
210 BOMBA CON TEMPERATURA ECOPACT	97.1	0.166	522	6.1e-05	1.28	0.0034	8080
210 BOMBA CON RETARDANTE ECOPACT	96.5	0.165	522	6.1e-05	1.27	0.00339	8080
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	96.5	0.165	522	6.1e-05	1.27	0.00339	8080
210 BOMBA CON FIBRA ECOPACT	99.4	0.17	535	6.24e-05	1.31	0.00349	8290
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	98.9	0.169	535	6.24e-05	1.3	0.00348	8290
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	99.4	0.17	535	6.24e-05	1.31	0.00349	8290
210 BOMBA PP ECOPACT	96.4	0.165	521	6.09e-05	1.27	0.00339	8070
210 BOMBA PP CON TEMPERATURA ECOPACT	96.4	0.165	521	6.09e-05	1.27	0.00339	8070
210 SEMIFLUIDO ECOPACT	102	0.174	552	6.4e-05	1.33	0.0036	8560
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	102	0.174	552	6.4e-05	1.33	0.0036	8560

210 SEMIFLUIDO CON RETARDANTE ECOPACT	102	0.174	552	6.4e-05	1.33	0.0036	8560
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	102	0.174	552	6.4e-05	1.33	0.0036	8560
210 SEMIFLUIDO CON FIBRA ECOPACT	102	0.175	554	6.43e-05	1.34	0.00361	8580
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	102	0.175	554	6.43e-05	1.34	0.00361	8580
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	102	0.175	554	6.43e-05	1.34	0.00361	8580
210 SEMIFLUIDO 3/8 ECOPACT	107	0.184	593	6.8e-05	1.39	0.00386	9210
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	108	0.186	600	6.87e-05	1.4	0.00391	9310
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	107	0.184	593	6.8e-05	1.39	0.00386	9210
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	108	0.186	600	6.87e-05	1.4	0.00391	9310
210 FLUIDO ECOPACT	102	0.175	560	6.49e-05	1.33	0.00364	8670
210 FLUIDO CON TEMPERATURA ECOPACT	102	0.175	560	6.49e-05	1.33	0.00364	8670
210 FLUIDO CON RETARDANTE ECOPACT	102	0.175	560	6.49e-05	1.33	0.00364	8670
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	102	0.175	560	6.49e-05	1.33	0.00364	8670
210 FLUIDO CON FIBRA ECOPACT	103	0.177	566	6.56e-05	1.35	0.00369	8780
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	103	0.177	566	6.56e-05	1.35	0.00369	8770
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	103	0.177	566	6.56e-05	1.35	0.00369	8770

210 FLUIDO 3/8 ECOPACT	110	0.189	612	7e-05	1.43	0.00399	9500
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	110	0.189	612	7e-05	1.43	0.00399	9500
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	110	0.189	612	7e-05	1.43	0.00399	9500
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	110	0.189	612	7e-05	1.43	0.00399	9500
210 LANZADO ECOPACT	110	0.19	619	7.07e-05	1.43	0.00403	9610
210 LANZADO CON TEMPERATURA ECOPACT	110	0.19	619	7.07e-05	1.43	0.00403	9610
210 PERMEABLE ECOPACT	131	0.22	691	7.71e-05	1.71	0.00456	10700
245 DIRECTO ECOPACT	105	0.178	560	6.48e-05	1.37	0.00365	8670
245 BOMBA ECOPACT	105	0.179	565	6.53e-05	1.37	0.00369	8760
250 DIRECTO ECOPACT	105	0.178	560	6.48e-05	1.37	0.00365	8670
250 BOMBA ECOPACT	105	0.179	565	6.53e-05	1.37	0.00369	8760

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	8950	241	8720	230	0.00415	1.02	85.5	0.00791	0.105	0.000452	0	0.212
Maximum	12000	334	11600	307	0.00566	12.6	97.7	0.00949	0.205	0.000452	0	0.212
Mean	9710	263	9440	250	0.00458	10.2	89.2	0.00835	0.189	0.000452	0	0.212
Median	9560	260	9300	246	0.00451	9.91	88.9	0.00828	0.189	0.000452	0	0.212
210 DIRECTO ECOPACT	9230	249	8940	237	0.00432	9.14	87.7	0.00811	0.178	0.000452	0	0.212
210 DIRECTO CON TEMPERATURA ECOPACT	9220	248	8980	238	0.00439	9.14	87.7	0.00811	0.178	0.000452	0	0.212

210 DIRECTO CON RETARDANTE ECOPACT	9200	251	8910	237	0.00439	9.14	87.7	0.00811	0.178	0.000452	0	0.212
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	9240	249	8990	237	0.00434	9.14	87.7	0.00811	0.178	0.000452	0	0.212
210 DIRECTO CON FIBRA ECOPACT	9390	257	9180	243	0.00448	8.96	88.6	0.00823	0.189	0.000452	0	0.212
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	9430	256	9170	243	0.00443	8.96	88.6	0.00823	0.189	0.000452	0	0.212
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	9480	257	9190	243	0.00449	8.96	88.6	0.00823	0.189	0.000452	0	0.212
210 BOMBA ECOPACT	8980	245	8750	231	0.00428	9.81	85.9	0.00793	0.184	0.000452	0	0.212
210 BOMBA CON TEMPERATURA ECOPACT	9010	242	8750	231	0.0042	9.81	85.9	0.00793	0.184	0.000452	0	0.212
210 BOMBA CON RETARDANTE ECOPACT	8980	245	8750	231	0.00427	10.4	85.8	0.00793	0.189	0.000452	0	0.212
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	8970	242	8730	231	0.00417	10.4	85.8	0.00793	0.189	0.000452	0	0.212
210 BOMBA CON FIBRA ECOPACT	9230	250	8950	237	0.00435	9.84	87.4	0.00809	0.189	0.000452	0	0.212

210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	9230	249	8960	237	0.00428	10.4	87.3	0.00809	0.189	0.000452	0	0.212
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	9200	247	8970	237	0.00438	9.84	87.4	0.00809	0.189	0.000452	0	0.212
210 BOMBA PP ECOPACT	8970	244	8720	231	0.00415	10.3	85.5	0.00791	0.184	0.000452	0	0.212
210 BOMBA PP CON TEMPERATURA ECOPACT	8950	241	8750	230	0.00434	10.3	85.5	0.00791	0.184	0.000452	0	0.212
210 SEMIFLUIDO ECOPACT	9510	259	9270	245	0.00461	9.89	88.2	0.00823	0.189	0.000452	0	0.212
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	9530	259	9280	245	0.00441	9.89	88.2	0.00823	0.189	0.000452	0	0.212
210 SEMIFLUIDO CON RETARDANTE ECOPACT	9540	257	9230	244	0.00448	9.89	88.2	0.00823	0.189	0.000452	0	0.212
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9490	257	9230	245	0.0045	9.89	88.2	0.00823	0.189	0.000452	0	0.212
210 SEMIFLUIDO CON FIBRA ECOPACT	9560	257	9300	246	0.00453	9.91	88.9	0.00828	0.2	0.000452	0	0.212
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	9560	260	9280	245	0.00451	9.91	88.9	0.00828	0.2	0.000452	0	0.212
210 SEMIFLUIDO	9550	259	9280	245	0.0045	9.91	88.9	0.00828	0.2	0.000452	0	0.212

CON FRIBRA Y TEMPERATURA ECOPACT												
210 SEMIFLUIDO 3/8 ECOPACT	10200	279	9960	264	0.00485	11.6	90.6	0.0086	0.2	0.000452	0	0.212
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	10300	280	10100	266	0.0049	11.6	91.2	0.00867	0.2	0.000452	0	0.212
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	10200	279	9960	263	0.0048	11.6	90.6	0.0086	0.2	0.000452	0	0.212
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10300	279	10100	266	0.00495	11.6	91.2	0.00867	0.2	0.000452	0	0.212
210 FLUIDO ECOPACT	9640	265	9410	248	0.0045	11.4	89.3	0.00834	0.194	0.000452	0	0.212
210 FLUIDO CON TEMPERATURA ECOPACT	9630	262	9400	248	0.00451	11.4	89.3	0.00834	0.194	0.000452	0	0.212
210 FLUIDO CON RETARDANTE ECOPACT	9670	261	9380	248	0.00451	11.4	89.3	0.00834	0.194	0.000452	0	0.212
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9650	260	9350	248	0.00454	11.4	89.3	0.00834	0.194	0.000452	0	0.212
210 FLUIDO CON FIBRA ECOPACT	9750	264	9480	251	0.00457	11.4	90.1	0.00843	0.194	0.000452	0	0.212
210 FLUIDO CON FIBRA Y	9780	265	9480	251	0.0046	11.3	90	0.00842	0.194	0.000452	0	0.212

RETARDANTE ECOPACT												
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9730	267	9460	251	0.0047	11.3	90	0.00842	0.194	0.00052	0	0.212
210 FLUIDO 3/8 ECOPACT	10600	287	10300	272	0.00503	11.6	92.3	0.0088	0.205	0.00052	0	0.212
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	10600	288	10300	273	0.00493	11.6	92.3	0.0088	0.205	0.00052	0	0.212
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	10600	286	10300	272	0.00494	11.6	92.3	0.0088	0.205	0.00052	0	0.212
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10500	288	10300	272	0.005	11.6	92.3	0.0088	0.205	0.00052	0	0.212
210 LANZADO ECOPACT	10700	288	10400	274	0.00507	12.6	93.1	0.00889	0.184	0.00052	0	0.212
210 LANZADO CON TEMPERATURA ECOPACT	10700	289	10400	274	0.00497	12.6	93.1	0.00889	0.184	0.00052	0	0.212
210 PERMEABLE ECOPACT	12000	334	11600	307	0.00566	1.02	97.7	0.00949	0.105	0.00052	0	0.212
245 DIRECTO ECOPACT	9650	262	9380	247	0.00464	8.36	89.3	0.00833	0.184	0.00052	0	0.212
245 BOMBA ECOPACT	9730	262	9490	251	0.00461	9.31	89.5	0.00838	0.189	0.00052	0	0.212
250 DIRECTO ECOPACT	9640	262	9330	249	0.00459	8.36	89.3	0.00833	0.184	0.00052	0	0.212
250 BOMBA ECOPACT	9770	265	9460	250	0.00461	9.31	89.5	0.00838	0.189	0.00052	0	0.212

Mix designs: 26 to 30 MPa

Table 13: **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	112	0.191	603	6.91e-05	1.47	0.00395	9350
Maximum	135	0.23	741	8.29e-05	1.76	0.00486	11500
Mean	119	0.204	654	7.42e-05	1.56	0.00428	10100
Median	117	0.2	641	7.3e-05	1.53	0.00419	9950
280 DIRECTO ECOPACT	112	0.191	603	6.91e-05	1.47	0.00395	9350
280 DIRECTO CON TEMPERATURA ECOPACT	112	0.191	603	6.91e-05	1.47	0.00395	9350
280 DIRECTO CON RETARDANTE ECOPACT	112	0.191	603	6.91e-05	1.47	0.00395	9350
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	112	0.191	603	6.91e-05	1.47	0.00395	9350
280 DIRECTO CON FIBRA ECOPACT	114	0.193	610	6.98e-05	1.49	0.004	9460
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	114	0.193	610	6.98e-05	1.49	0.004	9460
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	114	0.193	610	6.98e-05	1.49	0.004	9460
280 BOMBA ECOPACT	116	0.197	627	7.15e-05	1.51	0.00411	9730
280 BOMBA CON TEMPERATURA ECOPACT	116	0.197	627	7.15e-05	1.51	0.00411	9730
280 BOMBA CON RETARDANTE ECOPACT	116	0.197	627	7.15e-05	1.51	0.00411	9730
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	116	0.197	627	7.15e-05	1.51	0.00411	9730
280 BOMBA CON FIBRA ECOPACT	117	0.199	634	7.22e-05	1.53	0.00415	9840

280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	117	0.199	634	7.22e-05	1.53	0.00415	9840
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	117	0.199	634	7.22e-05	1.53	0.00415	9840
280 BOMBA PP ECOPACT	115	0.196	627	7.15e-05	1.5	0.0041	9730
280 BOMBA PP CON TEMPERATURA ECOPACT	115	0.196	627	7.15e-05	1.5	0.0041	9730
280 SEMIFLUIDO ECOPACT	115	0.198	634	7.23e-05	1.5	0.00414	9840
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	115	0.198	634	7.23e-05	1.5	0.00414	9840
280 SEMIFLUIDO CON RETARDANTE ECOPACT	115	0.198	634	7.23e-05	1.5	0.00414	9840
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	115	0.198	634	7.23e-05	1.5	0.00414	9840
280 SEMIFLUIDO CON FIBRA ECOPACT	117	0.2	641	7.3e-05	1.52	0.00419	9950
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	117	0.2	641	7.3e-05	1.52	0.00419	9950
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	117	0.2	641	7.3e-05	1.52	0.00419	9950
280 SEMIFLUIDO 3/8 ECOPACT	122	0.208	670	7.58e-05	1.58	0.00438	10400
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	123	0.21	677	7.64e-05	1.6	0.00443	10500
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	122	0.208	670	7.58e-05	1.58	0.00438	10400
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	123	0.21	677	7.64e-05	1.6	0.00443	10500
280 FLUIDO ECOPACT	117	0.201	647	7.37e-05	1.53	0.00422	10000

280 FLUIDO CON TEMPERATURA ECOPACT	117	0.201	647	7.37e-05	1.53	0.00422	10000
280 FLUIDO CON RETARDANTE ECOPACT	118	0.203	653	7.44e-05	1.54	0.00427	10100
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	118	0.203	653	7.44e-05	1.54	0.00427	10100
280 FLUIDO CON FIBRA ECOPACT	118	0.203	653	7.43e-05	1.54	0.00427	10100
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	118	0.203	653	7.43e-05	1.54	0.00427	10100
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	118	0.203	653	7.43e-05	1.54	0.00427	10100
280 FLUIDO 3/8 ECOPACT	126	0.215	695	7.82e-05	1.63	0.00455	10800
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	126	0.215	695	7.82e-05	1.63	0.00455	10800
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	126	0.215	695	7.82e-05	1.63	0.00455	10800
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	126	0.215	695	7.82e-05	1.63	0.00455	10800
280 LANZADO ECOPACT	126	0.217	707	8.02e-05	1.63	0.00461	11000
280 LANZADO CON TEMPERATURA ECOPACT	125	0.214	701	7.9e-05	1.61	0.00457	10900
300 BOMBA ECOPACT	135	0.23	741	8.29e-05	1.76	0.00486	11500
300 BOMBA CON RETARDANTE ECOPACT	135	0.23	741	8.29e-05	1.76	0.00486	11500
300 BOMBA CON TEMPERATURA ECOPACT	135	0.23	741	8.29e-05	1.76	0.00486	11500
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	135	0.23	741	8.29e-05	1.76	0.00486	11500

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	10400	284	10100	267	0.00485	7.2	93.1	0.00878	0.184	0.000452	0	0.212
Maximum	12800	356	12500	330	0.00605	13.1	105	0.0102	0.205	0.000452	0	0.212
Mean	11300	310	11000	290	0.00531	9.06	97.2	0.0093	0.198	0.000452	0	0.212
Median	11100	303	10800	284	0.00523	9.04	96.4	0.00919	0.2	0.000452	0	0.212
280 DIRECTO ECOPACT	10400	284	10100	267	0.00495	7.65	93.1	0.00878	0.184	0.000452	0	0.212
280 DIRECTO CON TEMPERATURA ECOPACT	10400	285	10100	267	0.00489	7.65	93.1	0.00878	0.184	0.000452	0	0.212
280 DIRECTO CON RETARDANTE ECOPACT	10400	285	10200	268	0.00485	7.65	93.1	0.00878	0.184	0.000452	0	0.212
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	10400	285	10100	268	0.00489	7.65	93.1	0.00878	0.184	0.000452	0	0.212
280 DIRECTO CON FIBRA ECOPACT	10500	291	10300	271	0.00498	7.67	93.9	0.00887	0.189	0.000452	0	0.212
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	10500	290	10200	271	0.00493	7.67	93.9	0.00887	0.189	0.000452	0	0.212
280 DIRECTO CON FRIBRA Y	10500	292	10200	271	0.00492	7.67	93.9	0.00887	0.189	0.000452	0	0.212

TEMPERATURA ECOPACT												
280 BOMBA ECOPACT	10800	299	10500	279	0.00498	8.21	94.7	0.00901	0.2	0.000452	0	0.212
280 BOMBA CON TEMPERATURA ECOPACT	10800	298	10500	279	0.00504	8.21	94.7	0.00901	0.2	0.000452	0	0.212
280 BOMBA CON RETARDANTE ECOPACT	10800	296	10500	278	0.00505	8.2	94.7	0.00901	0.194	0.000452	0	0.212
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10800	296	10500	279	0.005	8.2	94.7	0.00901	0.194	0.000452	0	0.212
280 BOMBA CON FIBRA ECOPACT	11000	301	10700	281	0.0052	8.22	95.5	0.00909	0.2	0.000452	0	0.212
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	10900	303	10700	282	0.00523	8.22	95.5	0.00909	0.2	0.000452	0	0.212
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	10900	299	10600	282	0.00517	8.22	95.5	0.00909	0.2	0.000452	0	0.212
280 BOMBA PP ECOPACT	10800	297	10600	279	0.00516	9.06	94.6	0.00901	0.2	0.000452	0	0.212
280 BOMBA PP CON TEMPERATURA ECOPACT	10800	297	10500	278	0.00508	9.06	94.6	0.00901	0.2	0.000452	0	0.212
280 SEMIFLUIDO ECOPACT	10900	298	10700	282	0.00512	10	95.6	0.00911	0.2	0.000452	0	0.212
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	11000	300	10600	282	0.00517	10	95.6	0.00911	0.2	0.000452	0	0.212

280 SEMIFLUIDO CON RETARDANTE ECOPACT	10900	299	10600	281	0.0051	10	95.6	0.00911	0.2	0.000452	0	0.212
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11000	299	10600	281	0.00513	10	95.6	0.00911	0.2	0.000452	0	0.212
280 SEMIFLUIDO CON FIBRA ECOPACT	11000	303	10800	284	0.00518	10	96.4	0.00919	0.205	0.000452	0	0.212
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	11100	303	10700	284	0.00524	10	96.4	0.00919	0.205	0.000452	0	0.212
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11100	302	10800	284	0.00523	10	96.4	0.00919	0.205	0.000452	0	0.212
280 SEMIFLUIDO 3/8 ECOPACT	11600	319	11200	298	0.00554	9.06	97.9	0.00943	0.2	0.000452	0	0.212
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	11700	321	11400	301	0.00536	9.07	98.6	0.0095	0.2	0.000452	0	0.212
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	11600	318	11300	298	0.00552	9.06	97.9	0.00943	0.2	0.000452	0	0.212
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATU	11700	322	11300	301	0.00549	9.07	98.6	0.0095	0.2	0.000452	0	0.212

RA ECOPACT												
280 FLUIDO ECOPACT	11200	304	10800	287	0.00525	10.4	96.9	0.00925	0.2	0.000452	0	0.212
280 FLUIDO CON TEMPERATURA ECOPACT	11200	304	10800	287	0.00523	10.4	96.9	0.00925	0.2	0.000452	0	0.212
280 FLUIDO CON RETARDANTE ECOPACT	11300	311	11000	290	0.00527	10.5	97.5	0.00933	0.2	0.000452	0	0.212
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11300	311	11000	290	0.00532	10.5	97.5	0.00933	0.2	0.000452	0	0.212
280 FLUIDO CON FIBRA ECOPACT	11300	311	11000	291	0.00533	10.5	97.4	0.00932	0.205	0.000452	0	0.212
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	11300	311	11000	290	0.00524	10.5	97.4	0.00932	0.205	0.000452	0	0.212
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11300	309	11000	291	0.00542	10.5	97.4	0.00932	0.205	0.000452	0	0.212
280 FLUIDO 3/8 ECOPACT	12000	328	11600	308	0.00562	9.01	99.8	0.00967	0.2	0.000452	0	0.212
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	12000	329	11700	309	0.0056	9.01	99.8	0.00967	0.2	0.000452	0	0.212
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	12000	332	11700	309	0.00563	9.01	99.8	0.00967	0.2	0.000452	0	0.212
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATU	12000	329	11700	309	0.0057	9.01	99.8	0.00967	0.2	0.000452	0	0.212

RA ECOPACT												
280 LANZADO ECOPACT	12200	335	11900	315	0.00572	13.1	104	0.00999	0.2	0.00052	0	0.212
280 LANZADO CON TEMPERATURA ECOPACT	12100	334	11800	312	0.0056	11.8	100	0.00976	0.2	0.00052	0	0.212
300 BOMBA ECOPACT	12800	356	12400	329	0.00603	7.2	105	0.0102	0.2	0.00052	0	0.212
300 BOMBA CON RETARDANTE ECOPACT	12800	352	12500	329	0.00605	7.2	105	0.0102	0.2	0.00052	0	0.212
300 BOMBA CON TEMPERATURA ECOPACT	12800	354	12500	330	0.00603	7.2	105	0.0102	0.2	0.00052	0	0.212
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12800	353	12500	329	0.00599	7.2	105	0.0102	0.2	0.00052	0	0.212

Mix designs: 31 to 35 MPa

Table 14: **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	132	0.224	721	8.09e-05	1.71	0.00473	11200
Maximum	139	0.237	765	8.55e-05	1.8	0.00502	11900
Mean	136	0.232	746	8.36e-05	1.76	0.0049	11600
Median	137	0.234	753	8.43e-05	1.78	0.00494	11700
350 BOMBA ECOPACT	137	0.234	753	8.43e-05	1.78	0.00494	11700
350 BOMBA CON RETARDANTE ECOPACT	137	0.234	753	8.43e-05	1.78	0.00494	11700

350 BOMBA CON TEMPERATURA ECOPACT	137	0.234	753	8.43e-05	1.78	0.00494	11700
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	137	0.234	753	8.43e-05	1.78	0.00494	11700
350 SEMIFLUIDO ECOPACT	132	0.224	722	8.1e-05	1.71	0.00473	11200
350 SEMIFLUIDO CON RETARDANTE ECOPACT	132	0.224	721	8.1e-05	1.71	0.00473	11200
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	132	0.224	721	8.1e-05	1.71	0.00473	11200
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	132	0.224	721	8.09e-05	1.71	0.00473	11200
350 FLUIDO ECOPACT	139	0.237	765	8.55e-05	1.8	0.00502	11900
350 FLUIDO CON RETARDANTE ECOPACT	139	0.237	765	8.55e-05	1.8	0.00502	11900
350 FLUIDO CON TEMPERATURA ECOPACT	139	0.237	765	8.55e-05	1.8	0.00502	11900
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	139	0.237	765	8.55e-05	1.8	0.00502	11900

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	12500	343	12100	320	0.00583	7.72	103	0.00998	0.2	0.000452	0	0.212
Maximum	13300	369	12900	341	0.00625	7.9	107	0.0105	0.205	0.000452	0	0.212
Mean	12900	357	12600	332	0.00607	7.8	105	0.0103	0.203	0.000452	0	0.212
Median	13000	360	12600	336	0.00613	7.83	106	0.0104	0.205	0.000452	0	0.212
350 BOMBA ECOPACT	13000	361	12700	334	0.00613	7.72	106	0.0104	0.2	0.000452	0	0.212
350 BOMBA CON	13100	360	12600	336	0.00613	7.72	106	0.0104	0.2	0.000452	0	0.212

RETARDANTE ECOPACT												
350 BOMBA CON TEMPERATURA ECOPACT	13000	361	12600	335	0.00617	7.72	106	0.0104	0.2	0.000452	0	0.212
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	13100	360	12700	336	0.0061	7.72	106	0.0104	0.2	0.000452	0	0.212
350 SEMIFLUIDO ECOPACT	12500	346	12200	321	0.00587	7.9	103	0.01	0.205	0.000452	0	0.212
350 SEMIFLUIDO CON RETARDANTE ECOPACT	12500	343	12100	321	0.00588	7.86	103	0.01	0.205	0.000452	0	0.212
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	12500	345	12200	320	0.00583	7.86	103	0.01	0.205	0.000452	0	0.212
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12500	344	12100	321	0.00586	7.77	103	0.00998	0.205	0.000452	0	0.212
350 FLUIDO ECOPACT	13300	369	12900	341	0.00625	7.83	107	0.0105	0.205	0.000452	0	0.212
350 FLUIDO CON RETARDANTE ECOPACT	13300	364	12900	341	0.00621	7.83	107	0.0105	0.205	0.000452	0	0.212
350 FLUIDO CON TEMPERATURA ECOPACT	13200	366	12900	340	0.00621	7.83	107	0.0105	0.205	0.000452	0	0.212
350 FLUIDO CON RETARDANTE Y TEMPERATU	13200	366	12800	341	0.00625	7.83	107	0.0105	0.205	0.000452	0	0.212

RA ECOPACT												

Mix designs: 41 to 45 MPa

Table 15: **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	131	0.223	716	8.06e-05	1.7	0.0047	11100
Maximum	134	0.228	734	8.23e-05	1.74	0.00482	11400
Mean	133	0.226	728	8.17e-05	1.73	0.00478	11300
Median	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 BOMBA ECOPACT	131	0.223	716	8.06e-05	1.7	0.0047	11100
420 BOMBA CON RETARDANTE ECOPACT	131	0.223	716	8.06e-05	1.7	0.0047	11100
420 BOMBA CON TEMPERATURA ECOPACT	131	0.223	716	8.06e-05	1.7	0.0047	11100
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	131	0.223	716	8.06e-05	1.7	0.0047	11100
420 SEMIFLUIDO ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 SEMIFLUIDO CON RETARDANTE ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 FLUIDO ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 FLUIDO CON RETARDANTE ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400
420 FLUIDO CON TEMPERATURA ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400

420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	134	0.228	734	8.23e-05	1.74	0.00482	11400

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	12400	338	12000	317	0.0057	7.91	103	0.00997	0.2	0.000452	0	0.212
Maximum	12700	353	12400	327	0.006	7.98	104	0.0101	0.2	0.000452	0	0.212
Mean	12600	347	12200	324	0.00591	7.93	104	0.0101	0.2	0.000452	0	0.212
Median	12700	350	12300	326	0.00595	7.91	104	0.0101	0.2	0.000452	0	0.212
420 BOMBA ECOPACT	12400	341	12000	319	0.00591	7.98	103	0.00997	0.2	0.000452	0	0.212
420 BOMBA CON RETARDANTE ECOPACT	12400	338	12000	319	0.00587	7.98	103	0.00997	0.2	0.000452	0	0.212
420 BOMBA CON TEMPERATURA ECOPACT	12400	340	12000	318	0.00581	7.98	103	0.00997	0.2	0.000452	0	0.212
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12400	341	12100	317	0.0057	7.98	103	0.00997	0.2	0.000452	0	0.212
420 SEMIFLUIDO ECOPACT	12700	352	12400	326	0.0059	7.91	104	0.0101	0.2	0.000452	0	0.212
420 SEMIFLUIDO CON RETARDANTE ECOPACT	12700	348	12400	327	0.00595	7.91	104	0.0101	0.2	0.000452	0	0.212
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	12700	351	12400	327	0.006	7.91	104	0.0101	0.2	0.000452	0	0.212

420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12700	353	12300	326	0.00595	7.91	104	0.0101	0.2	0.000452	0	0.212
420 FLUIDO ECOPACT	12700	352	12300	326	0.00596	7.91	104	0.0101	0.2	0.000452	0	0.212
420 FLUIDO CON RETARDANTE ECOPACT	12700	349	12300	327	0.00594	7.91	104	0.0101	0.2	0.000452	0	0.212
420 FLUIDO CON TEMPERATURA ECOPACT	12700	351	12400	326	0.00598	7.91	104	0.0101	0.2	0.000452	0	0.212
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12700	352	12300	327	0.00599	7.91	104	0.0101	0.2	0.000452	0	0.212

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.