ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT SANTA ANA** facility in Santa Ana, 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 April 2023
Period of Validity:	5 years; valid until 13 April 2028
EPD Number:	e45a4cd5-194f-451e-b6e6-8d22683a4328

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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 Santa Ana concrete facility in Santa Ana, 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:

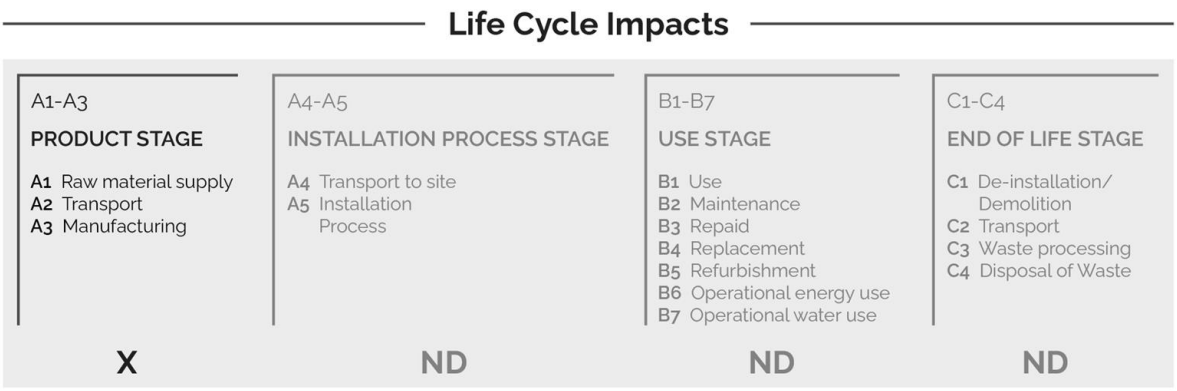

Figure 1: **General life cycle phases for consideration in a construction works system.**

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.

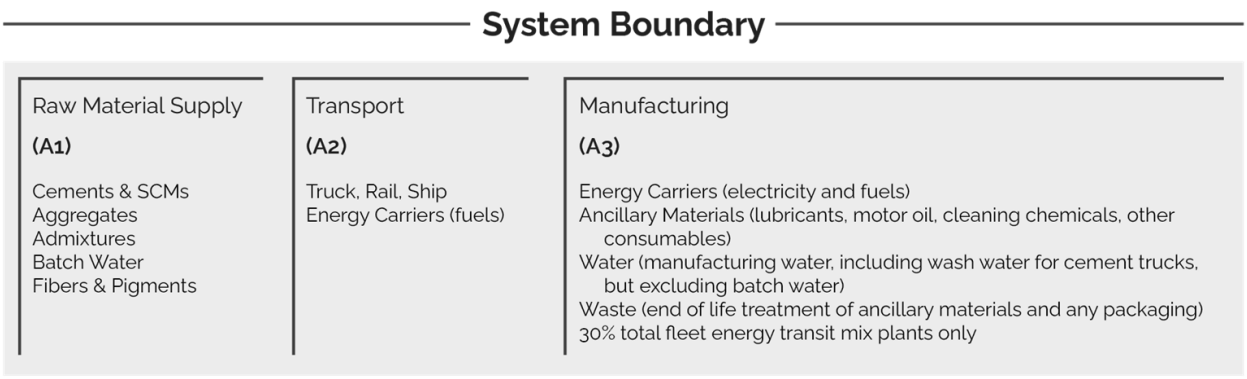

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

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 Santa Ana 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/activities 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 wastes. 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	El 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	75.8	0.221	429	4.89e-05	1.01	0.00255	6170
Maximum	84.2	0.235	472	5.32e-05	1.12	0.00285	6850
Mean	80	0.228	450	5.1e-05	1.07	0.00269	6500
Median	79.4	0.227	444	5.08e-05	1.06	0.00266	6420
100 BOMBA ECOPACT	75.8	0.221	429	4.89e-05	1.01	0.00255	6170
100 BOMBA CON TEMPERATURA ECOPACT	75.8	0.221	429	4.89e-05	1.01	0.00255	6170
100 BOMBA CON RETARDANTE ECOPACT	75.8	0.221	429	4.89e-05	1.01	0.00255	6170
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	75.8	0.221	429	4.89e-05	1.01	0.00255	6170
100 BOMBA CON FIBRA ECOPACT	78.1	0.225	442	5.02e-05	1.04	0.00264	6380

100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	78.1	0.225	442	5.02e-05	1.04	0.00264	6380
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	78.1	0.225	442	5.02e-05	1.04	0.00264	6380
100 DIRECTO ECOPACT	76.8	0.223	430	4.91e-05	1.03	0.00256	6190
100 DIRECTO CON TEMPERATURA ECOPACT	76.8	0.223	430	4.91e-05	1.03	0.00256	6190
100 DIRECTO CON RETARDANTE ECOPACT	79.4	0.227	444	5.08e-05	1.06	0.00266	6420
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	79.4	0.227	444	5.08e-05	1.06	0.00266	6420
100 DIRECTO CON FIBRA ECOPACT	79.5	0.227	445	5.08e-05	1.06	0.00266	6420
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	79.5	0.227	445	5.08e-05	1.06	0.00266	6420
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	79.5	0.227	445	5.08e-05	1.06	0.00266	6420
140 DIRECTO ECOPACT	83.5	0.234	470	5.27e-05	1.11	0.00283	6810
140 DIRECTO CON RETARDANTE ECOPACT	83.5	0.234	470	5.27e-05	1.11	0.00283	6810
140 DIRECTO CON TEMPERATURA ECOPACT	83.5	0.234	470	5.27e-05	1.11	0.00283	6810
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	83.5	0.234	470	5.27e-05	1.11	0.00283	6810
140 BOMBA ECOPACT	84.2	0.235	472	5.32e-05	1.12	0.00285	6850
140 BOMBA CON RETARDANTE ECOPACT	84.2	0.235	472	5.32e-05	1.12	0.00285	6850
140 BOMBA CON TEMPERATURA ECOPACT	84.2	0.235	472	5.32e-05	1.12	0.00285	6850
140 BOMBA CON RETARDANTE Y	84.2	0.235	472	5.32e-05	1.12	0.00285	6850

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	6820	184	6640	175	0.00319	10.6	145	0.00674	0.178	0.00252	0	54.8
Maximum	7600	208	7400	195	0.00361	12	149	0.00718	0.189	0.00252	0	54.8
Mean	7200	195	7000	185	0.00339	11.5	147	0.00697	0.185	0.00252	0	54.8
Median	7100	192	6910	182	0.00336	11.9	147	0.007	0.184	0.00252	0	54.8
100 BOMBA ECOPACT	6840	185	6660	176	0.00322	12	145	0.00674	0.184	0.00252	0	54.8
100 BOMBA CON TEMPERATURA ECOPACT	6820	184	6640	176	0.00321	12	145	0.00674	0.184	0.00252	0	54.8
100 BOMBA CON RETARDANTE ECOPACT	6830	184	6660	176	0.00319	12	145	0.00674	0.184	0.00252	0	54.8
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	6850	185	6650	175	0.00319	12	145	0.00674	0.184	0.00252	0	54.8
100 BOMBA CON FIBRA ECOPACT	7080	190	6850	182	0.00334	12	147	0.00689	0.189	0.00252	0	54.8
100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	7070	191	6860	181	0.00332	12	147	0.00689	0.189	0.00252	0	54.8
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	7080	190	6860	182	0.00333	12	147	0.00689	0.189	0.00252	0	54.8
100 DIRECTO ECOPACT	6860	185	6670	176	0.00326	11.4	146	0.00677	0.178	0.00252	0	54.8
100 DIRECTO CON TEMPERATURA ECOPACT	6860	185	6670	176	0.00325	11.4	146	0.00677	0.178	0.00252	0	54.8

100 DIRECTO CON RETARDANTE ECOPACT	7100	192	6900	182	0.00334	11.9	148	0.007	0.178	0.00252	0	54.8
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7080	193	6910	183	0.00339	11.9	148	0.007	0.178	0.00252	0	54.8
100 DIRECTO CON FIBRA ECOPACT	7110	193	6930	183	0.00333	11.9	148	0.00701	0.189	0.00252	0	54.8
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	7110	193	6910	182	0.00339	11.9	148	0.00701	0.184	0.00252	0	54.8
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	7090	192	6920	183	0.0034	11.9	148	0.00701	0.189	0.00252	0	54.8
140 DIRECTO ECOPACT	7560	206	7350	194	0.00354	10.6	147	0.00708	0.184	0.00252	0	54.8
140 DIRECTO CON RETARDANTE ECOPACT	7550	206	7340	194	0.00353	10.6	147	0.00708	0.184	0.00252	0	54.8
140 DIRECTO CON TEMPERATURA ECOPACT	7560	207	7370	194	0.00356	10.6	147	0.00708	0.184	0.00252	0	54.8
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7540	206	7340	194	0.00352	10.6	147	0.00708	0.184	0.00252	0	54.8
140 BOMBA ECOPACT	7580	208	7400	195	0.00354	10.9	149	0.00718	0.189	0.00252	0	54.8
140 BOMBA CON RETARDANTE ECOPACT	7590	208	7360	195	0.00358	10.9	149	0.00718	0.189	0.00252	0	54.8
140 BOMBA CON TEMPERATURA ECOPACT	7580	207	7400	195	0.00361	10.9	149	0.00718	0.189	0.00252	0	54.8
140 BOMBA CON RETARDANTE Y	7600	208	7380	195	0.00356	10.9	149	0.00718	0.189	0.00252	0	54.8

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	87	0.24	489	5.48e-05	1.16	0.00296	7120
Maximum	90.2	0.245	504	5.64e-05	1.2	0.00306	7350
Mean	88.7	0.243	497	5.57e-05	1.18	0.00301	7240
Median	89	0.243	497	5.57e-05	1.18	0.00301	7240
180 BOMBA ECOPACT	87.4	0.241	491	5.51e-05	1.16	0.00297	7150
180 BOMBA CON TEMPERATURA ECOPACT	87.4	0.241	491	5.51e-05	1.16	0.00297	7150
180 BOMBA CON RETARDANTE ECOPACT	87.2	0.24	490	5.5e-05	1.16	0.00297	7130
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	87	0.24	489	5.48e-05	1.16	0.00296	7120
180 BOMBA CON FIBRA ECOPACT	89.3	0.244	502	5.61e-05	1.18	0.00305	7320
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	89.3	0.244	502	5.61e-05	1.18	0.00305	7320
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	89.3	0.244	502	5.61e-05	1.18	0.00305	7320
180 DIRECTO ECOPACT	88.1	0.242	492	5.52e-05	1.17	0.00298	7150
180 DIRECTO CON TEMPERATURA ECOPACT	88.1	0.242	492	5.52e-05	1.17	0.00298	7150
180 DIRECTO CON RETARDANTE ECOPACT	89	0.243	497	5.57e-05	1.18	0.00301	7240
180 DIRECTO CON RETARDANTE Y	89	0.243	497	5.57e-05	1.18	0.00301	7240

TEMPERATURA ECOPACT							
180 DIRECTO CON FIBRA ECOPACT	90.2	0.245	504	5.64e-05	1.2	0.00306	7350
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	90.2	0.245	504	5.64e-05	1.2	0.00306	7350
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	90.2	0.245	504	5.64e-05	1.2	0.00306	7350

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	7910	215	7700	203	0.00366	10.3	149	0.00731	0.178	0.00252	0	54.8
Maximum	8180	225	7930	210	0.00389	11	152	0.00752	0.189	0.00252	0	54.8
Mean	8030	220	7810	206	0.00378	10.6	151	0.00743	0.184	0.00252	0	54.8
Median	8060	220	7810	206	0.00377	10.5	151	0.00744	0.184	0.00252	0	54.8
180 BOMBA ECOPACT	7920	218	7710	203	0.00372	11	150	0.00738	0.184	0.00252	0	54.8
180 BOMBA CON TEMPERATURA ECOPACT	7910	215	7720	204	0.00366	11	150	0.00738	0.184	0.00252	0	54.8
180 BOMBA CON RETARDANTE ECOPACT	7930	216	7710	204	0.00376	10.8	150	0.00735	0.184	0.00252	0	54.8
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7910	217	7700	203	0.00373	10.6	149	0.00731	0.184	0.00252	0	54.8
180 BOMBA CON FIBRA ECOPACT	8100	223	7890	209	0.00381	10.7	151	0.00746	0.189	0.00252	0	54.8
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	8150	221	7920	209	0.00387	10.7	151	0.00746	0.189	0.00252	0	54.8

180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	8100	221	7900	209	0.00383	10.7	151	0.00746	0.189	0.00252	0	54.8
180 DIRECTO ECOPACT	7920	217	7730	205	0.0037	10.4	151	0.0074	0.178	0.00252	0	54.8
180 DIRECTO CON TEMPERATURA ECOPACT	7930	217	7720	204	0.00375	10.4	151	0.0074	0.178	0.00252	0	54.8
180 DIRECTO CON RETARDANTE ECOPACT	8040	221	7810	206	0.00377	10.3	151	0.00744	0.178	0.00252	0	54.8
180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	8070	220	7810	206	0.00377	10.3	151	0.00744	0.178	0.00252	0	54.8
180 DIRECTO CON FIBRA ECOPACT	8180	221	7930	209	0.00389	10.3	152	0.00752	0.189	0.00252	0	54.8
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	8140	225	7920	209	0.00379	10.3	152	0.00752	0.189	0.00252	0	54.8
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	8160	222	7930	210	0.00386	10.3	152	0.00752	0.189	0.00252	0	54.8

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	97.5	0.258	550	6.08e-05	1.29	0.00337	8080
Maximum	104	0.27	592	6.49e-05	1.38	0.00365	8730
Mean	104	0.27	592	6.49e-05	1.38	0.00365	8730
Median	103	0.268	582	6.4e-05	1.36	0.00359	8580
210 DIRECTO ECOPACT	101	0.264	565	6.23e-05	1.34	0.00347	8300

210 DIRECTO CON TEMPERATURA ECOPACT	101	0.264	565	6.23e-05	1.34	0.00347	8300
210 DIRECTO CON RETARDANTE ECOPACT	101	0.264	565	6.23e-05	1.34	0.00347	8300
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	101	0.264	565	6.23e-05	1.34	0.00347	8300
210 DIRECTO CON FIBRA ECOPACT	103	0.267	576	6.34e-05	1.37	0.00355	8480
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	103	0.267	576	6.34e-05	1.37	0.00355	8480
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	103	0.267	576	6.34e-05	1.37	0.00355	8480
210 BOMBA ECOPACT	98.2	0.259	551	6.09e-05	1.3	0.00338	8090
210 BOMBA CON TEMPERATURA ECOPACT	98.2	0.259	551	6.09e-05	1.3	0.00338	8090
210 BOMBA CON RETARDANTE ECOPACT	97.6	0.258	551	6.09e-05	1.29	0.00337	8090
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	97.6	0.258	551	6.09e-05	1.29	0.00337	8090
210 BOMBA CON FIBRA ECOPACT	100	0.263	564	6.23e-05	1.33	0.00347	8290
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	99.9	0.262	564	6.23e-05	1.32	0.00346	8290
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	100	0.263	564	6.23e-05	1.33	0.00347	8290
210 BOMBA PP ECOPACT	97.5	0.258	550	6.08e-05	1.29	0.00337	8080
210 BOMBA PP CON TEMPERATURA ECOPACT	97.5	0.258	550	6.08e-05	1.29	0.00337	8080
210 SEMIFLUIDO ECOPACT	103	0.267	581	6.38e-05	1.36	0.00358	8560
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	103	0.267	581	6.38e-05	1.36	0.00358	8560

210 SEMIFLUIDO CON RETARDANTE ECOPACT	103	0.267	581	6.38e-05	1.36	0.00358	8560
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	103	0.267	581	6.38e-05	1.36	0.00358	8560
210 SEMIFLUIDO CON FIBRA ECOPACT	103	0.268	582	6.4e-05	1.36	0.00359	8580
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	103	0.268	582	6.4e-05	1.36	0.00359	8580
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	103	0.268	582	6.4e-05	1.36	0.00359	8580
210 SEMIFLUIDO 3/8 ECOPACT	108	0.276	622	6.77e-05	1.41	0.00384	9200
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	109	0.278	628	6.84e-05	1.42	0.00388	9300
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	108	0.276	622	6.77e-05	1.41	0.00384	9200
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	109	0.278	628	6.84e-05	1.42	0.00388	9300
210 FLUIDO ECOPACT	103	0.268	589	6.48e-05	1.36	0.00362	8680
210 FLUIDO CON TEMPERATURA ECOPACT	103	0.268	589	6.48e-05	1.36	0.00362	8680
210 FLUIDO CON RETARDANTE ECOPACT	103	0.268	589	6.48e-05	1.36	0.00362	8680
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	103	0.268	589	6.48e-05	1.36	0.00362	8680
210 FLUIDO CON FIBRA ECOPACT	104	0.27	595	6.55e-05	1.37	0.00367	8780
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	104	0.27	595	6.54e-05	1.37	0.00366	8780
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	104	0.27	595	6.54e-05	1.37	0.00366	8780

210 FLUIDO 3/8 ECOPACT	111	0.282	640	6.96e-05	1.45	0.00396	9490
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	111	0.282	640	6.96e-05	1.45	0.00396	9490
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	111	0.282	640	6.96e-05	1.45	0.00396	9490
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.282	640	6.96e-05	1.45	0.00396	9490
210 LANZADO ECOPACT	111	0.283	647	7.04e-05	1.45	0.004	9600
210 LANZADO CON TEMPERATURA ECOPACT	111	0.283	647	7.04e-05	1.45	0.004	9600
210 PERMEABLE ECOPACT	131	0.311	714	7.56e-05	1.72	0.0045	10600
245 DIRECTO ECOPACT	106	0.271	588	6.45e-05	1.39	0.00363	8660
245 BOMBA ECOPACT	106	0.271	593	6.5e-05	1.39	0.00366	8750
250 DIRECTO ECOPACT	106	0.271	588	6.45e-05	1.39	0.00363	8660
250 BOMBA ECOPACT	106	0.271	593	6.5e-05	1.39	0.00366	8750

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	247	8710	231	0.00418	1.01	154	0.00792	0.105	0.00252	0	54.8
Maximum	11900	339	11500	305	0.0057	12.6	161	0.00923	0.205	0.00252	0	54.8
Mean	9700	269	9430	249	0.00457	10.2	157	0.00832	0.189	0.00252	0	54.8
Median	9550	265	9310	246	0.0045	9.92	157	0.00826	0.189	0.00252	0	54.8
210 DIRECTO ECOPACT	9220	256	8920	238	0.00439	9.15	156	0.0081	0.178	0.00252	0	54.8
210 DIRECTO CON TEMPERATURA ECOPACT	9210	259	8920	236	0.0043	9.15	156	0.0081	0.178	0.00252	0	54.8
210 DIRECTO CON	9200	256	8970	237	0.00439	9.15	156	0.0081	0.178	0.00252	0	54.8

RETARDANTE ECOPACT												
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	9200	256	8930	237	0.00434	9.15	156	0.0081	0.178	0.00252	0	54.8
210 DIRECTO CON FIBRA ECOPACT	9410	261	9150	242	0.00443	8.96	156	0.0082	0.189	0.00252	0	54.8
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	9420	261	9140	242	0.00443	8.96	156	0.0082	0.189	0.00252	0	54.8
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	9420	263	9170	242	0.00445	8.96	156	0.0082	0.189	0.00252	0	54.8
210 BOMBA ECOPACT	9010	248	8740	231	0.00424	9.82	154	0.00794	0.184	0.00252	0	54.8
210 BOMBA CON TEMPERATURA ECOPACT	9000	251	8730	232	0.00428	9.82	154	0.00794	0.184	0.00252	0	54.8
210 BOMBA CON RETARDANTE ECOPACT	8950	249	8750	231	0.00426	10.4	154	0.00794	0.189	0.00252	0	54.8
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	9000	247	8730	231	0.00418	10.4	154	0.00794	0.189	0.00252	0	54.8
210 BOMBA CON FIBRA ECOPACT	9230	256	8970	237	0.00445	9.85	156	0.00809	0.189	0.00252	0	54.8
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	9210	255	8960	237	0.00431	10.4	155	0.00809	0.189	0.00252	0	54.8
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	9230	254	8960	236	0.00437	9.85	156	0.00809	0.189	0.00252	0	54.8
210 BOMBA PP ECOPACT	8970	248	8710	231	0.00419	10.3	154	0.00792	0.184	0.00252	0	54.8
210 BOMBA PP CON	9000	247	8740	231	0.00426	10.3	154	0.00792	0.184	0.00252	0	54.8

TEMPERATURA ECOPACT												
210 SEMIFLUIDO ECOPACT	9520	265	9240	244	0.00447	9.9	156	0.00821	0.189	0.00252	0	54.8
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	9540	263	9230	245	0.00451	9.9	156	0.00821	0.189	0.00252	0	54.8
210 SEMIFLUIDO CON RETARDANTE ECOPACT	9530	263	9250	244	0.00445	9.9	156	0.00821	0.189	0.00252	0	54.8
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9480	263	9240	245	0.00447	9.9	156	0.00821	0.189	0.00252	0	54.8
210 SEMIFLUIDO CON FIBRA ECOPACT	9550	265	9310	246	0.0045	9.92	157	0.00826	0.2	0.00252	0	54.8
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	9550	263	9260	246	0.00454	9.92	157	0.00826	0.2	0.00252	0	54.8
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9530	262	9270	244	0.00449	9.92	157	0.00826	0.2	0.00252	0	54.8
210 SEMIFLUIDO 3/8 ECOPACT	10200	284	9920	263	0.0048	11.6	158	0.00856	0.2	0.00252	0	54.8
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	10300	283	10000	265	0.00481	11.6	158	0.00863	0.2	0.00252	0	54.8
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	10200	283	9950	263	0.00477	11.6	158	0.00856	0.2	0.00252	0	54.8

210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10300	285	10100	265	0.00481	11.6	158	0.00863	0.2	0.00252	0	54.8
210 FLUIDO ECOPACT	9650	266	9370	248	0.00448	11.4	157	0.00834	0.194	0.00252	0	54.8
210 FLUIDO CON TEMPERATURA ECOPACT	9680	270	9390	248	0.00456	11.4	157	0.00834	0.194	0.00252	0	54.8
210 FLUIDO CON RETARDANTE ECOPACT	9640	264	9390	247	0.00451	11.4	157	0.00834	0.194	0.00252	0	54.8
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9640	265	9390	248	0.00451	11.4	157	0.00834	0.194	0.00252	0	54.8
210 FLUIDO CON FIBRA ECOPACT	9770	268	9470	251	0.00459	11.4	158	0.00842	0.194	0.00252	0	54.8
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	9750	270	9440	251	0.00462	11.3	158	0.0084	0.194	0.00252	0	54.8
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9740	268	9510	251	0.00461	11.3	158	0.0084	0.194	0.00252	0	54.8
210 FLUIDO 3/8 ECOPACT	10600	291	10200	271	0.00495	11.7	159	0.00875	0.205	0.00252	0	54.8
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	10500	291	10300	271	0.00492	11.7	159	0.00875	0.205	0.00252	0	54.8
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	10500	291	10300	272	0.00496	11.7	159	0.00875	0.205	0.00252	0	54.8
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10600	293	10200	271	0.00488	11.7	159	0.00875	0.205	0.00252	0	54.8

210 LANZADO ECOPACT	10700	295	10400	275	0.00503	12.6	160	0.00884	0.184	0.00252	0	54.8
210 LANZADO CON TEMPERATURA ECOPACT	10700	295	10400	274	0.00494	12.6	160	0.00884	0.184	0.00252	0	54.8
210 PERMEABLE ECOPACT	11900	339	11500	305	0.0057	1.01	161	0.00923	0.105	0.00252	0	54.8
245 DIRECTO ECOPACT	9610	271	9370	247	0.00456	8.37	157	0.00829	0.184	0.00252	0	54.8
245 BOMBA ECOPACT	9740	272	9470	250	0.0046	9.32	157	0.00833	0.189	0.00252	0	54.8
250 DIRECTO ECOPACT	9630	267	9330	248	0.0045	8.37	157	0.00829	0.184	0.00252	0	54.8
250 BOMBA ECOPACT	9760	270	9440	249	0.00465	9.32	157	0.00833	0.189	0.00252	0	54.8

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	113	0.283	630	6.85e-05	1.49	0.00391	9320
Maximum	136	0.322	764	8.16e-05	1.77	0.0048	11400
Mean	120	0.296	680	7.35e-05	1.57	0.00424	10100
Median	118	0.292	668	7.24e-05	1.54	0.00415	9920
280 DIRECTO ECOPACT	113	0.283	630	6.85e-05	1.49	0.00391	9320
280 DIRECTO CON TEMPERATURA ECOPACT	113	0.283	630	6.85e-05	1.49	0.00391	9320
280 DIRECTO CON RETARDANTE ECOPACT	113	0.283	630	6.85e-05	1.49	0.00391	9320
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	113	0.283	630	6.85e-05	1.49	0.00391	9320
280 DIRECTO CON FIBRA ECOPACT	114	0.285	637	6.92e-05	1.51	0.00396	9430

280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	114	0.285	637	6.92e-05	1.51	0.00396	9430
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	114	0.285	637	6.92e-05	1.51	0.00396	9430
280 BOMBA ECOPACT	116	0.289	654	7.08e-05	1.53	0.00407	9700
280 BOMBA CON TEMPERATURA ECOPACT	116	0.289	654	7.08e-05	1.53	0.00407	9700
280 BOMBA CON RETARDANTE ECOPACT	116	0.289	654	7.08e-05	1.53	0.00407	9700
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	116	0.289	654	7.08e-05	1.53	0.00407	9700
280 BOMBA CON FIBRA ECOPACT	118	0.291	660	7.15e-05	1.54	0.00412	9800
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	118	0.291	660	7.15e-05	1.54	0.00412	9800
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	118	0.291	660	7.15e-05	1.54	0.00412	9800
280 BOMBA PP ECOPACT	116	0.289	654	7.09e-05	1.52	0.00406	9700
280 BOMBA PP CON TEMPERATURA ECOPACT	116	0.289	654	7.09e-05	1.52	0.00406	9700
280 SEMIFLUIDO ECOPACT	116	0.29	661	7.17e-05	1.52	0.00411	9810
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	116	0.29	661	7.17e-05	1.52	0.00411	9810
280 SEMIFLUIDO CON RETARDANTE ECOPACT	116	0.29	661	7.17e-05	1.52	0.00411	9810
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	116	0.29	661	7.17e-05	1.52	0.00411	9810
280 SEMIFLUIDO CON FIBRA ECOPACT	117	0.292	668	7.24e-05	1.54	0.00415	9920
280 SEMIFLUIDO CON FIBRA Y	117	0.292	668	7.24e-05	1.54	0.00415	9920

RETARDANTE ECOPACT							
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	117	0.292	668	7.24e-05	1.54	0.00415	9920
280 SEMIFLUIDO 3/8 ECOPACT	122	0.3	696	7.49e-05	1.6	0.00434	10400
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	123	0.302	702	7.56e-05	1.61	0.00438	10500
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	122	0.3	696	7.49e-05	1.6	0.00434	10400
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	123	0.302	702	7.56e-05	1.61	0.00438	10500
280 FLUIDO ECOPACT	118	0.293	674	7.3e-05	1.54	0.00419	10000
280 FLUIDO CON TEMPERATURA ECOPACT	118	0.293	674	7.3e-05	1.54	0.00419	10000
280 FLUIDO CON RETARDANTE ECOPACT	119	0.295	680	7.37e-05	1.56	0.00423	10100
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	119	0.295	680	7.37e-05	1.56	0.00423	10100
280 FLUIDO CON FIBRA ECOPACT	119	0.295	680	7.36e-05	1.55	0.00423	10100
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	119	0.295	680	7.36e-05	1.55	0.00423	10100
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	119	0.295	680	7.36e-05	1.55	0.00423	10100
280 FLUIDO 3/8 ECOPACT	126	0.307	720	7.72e-05	1.65	0.0045	10700
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	126	0.307	720	7.72e-05	1.65	0.0045	10700
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	126	0.307	720	7.72e-05	1.65	0.0045	10700
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	126	0.307	720	7.72e-05	1.65	0.0045	10700

280 LANZADO ECOPACT	126	0.309	733	7.94e-05	1.64	0.00457	10900
280 LANZADO CON TEMPERATURA ECOPACT	125	0.306	726	7.81e-05	1.62	0.00453	10800
300 BOMBA ECOPACT	136	0.322	764	8.16e-05	1.77	0.0048	11400
300 BOMBA CON RETARDANTE ECOPACT	136	0.322	764	8.16e-05	1.77	0.0048	11400
300 BOMBA CON TEMPERATURA ECOPACT	136	0.322	764	8.16e-05	1.77	0.0048	11400
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	136	0.322	764	8.16e-05	1.77	0.0048	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	10300	291	10100	266	0.00476	7.2	160	0.00868	0.184	0.00252	0	54.8
Maximum	12700	363	12400	327	0.006	13.1	170	0.00997	0.205	0.00252	0	54.8
Mean	11200	315	10900	289	0.0053	9.06	163	0.00918	0.198	0.00252	0	54.8
Median	11000	308	10700	284	0.00519	9.04	163	0.00909	0.2	0.00252	0	54.8
280 DIRECTO ECOPACT	10400	291	10100	266	0.00491	7.65	160	0.00868	0.184	0.00252	0	54.8
280 DIRECTO CON TEMPERATURA ECOPACT	10400	291	10100	266	0.00476	7.65	160	0.00868	0.184	0.00252	0	54.8
280 DIRECTO CON RETARDANTE ECOPACT	10400	293	10100	266	0.00494	7.65	160	0.00868	0.184	0.00252	0	54.8
280 DIRECTO CON RETARDANTE Y	10300	291	10100	267	0.00493	7.65	160	0.00868	0.184	0.00252	0	54.8

TEMPERATURA ECOPACT												
280 DIRECTO CON FIBRA ECOPACT	10500	292	10200	269	0.00491	7.67	160	0.00876	0.189	0.00252	0	54.8
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	10500	292	10200	269	0.00499	7.67	160	0.00876	0.189	0.00252	0	54.8
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	10500	298	10200	269	0.005	7.67	160	0.00876	0.189	0.00252	0	54.8
280 BOMBA ECOPACT	10800	303	10500	277	0.00508	8.21	161	0.0089	0.2	0.00252	0	54.8
280 BOMBA CON TEMPERATURA ECOPACT	10800	303	10500	277	0.00515	8.21	161	0.0089	0.2	0.00252	0	54.8
280 BOMBA CON RETARDANTE ECOPACT	10800	303	10500	277	0.005	8.21	161	0.0089	0.194	0.00252	0	54.8
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10800	303	10500	277	0.0051	8.21	161	0.0089	0.194	0.00252	0	54.8
280 BOMBA CON FIBRA ECOPACT	10900	305	10600	280	0.00516	8.23	162	0.00898	0.2	0.00252	0	54.8
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	10900	304	10600	280	0.00511	8.23	162	0.00898	0.2	0.00252	0	54.8
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	10900	307	10600	280	0.00519	8.23	162	0.00898	0.2	0.00252	0	54.8
280 BOMBA PP ECOPACT	10800	298	10500	276	0.00512	9.06	161	0.00891	0.2	0.00252	0	54.8
280 BOMBA PP CON TEMPERATURA ECOPACT	10800	303	10500	277	0.00512	9.06	161	0.00891	0.2	0.00252	0	54.8

280 SEMIFLUIDO ECOPACT	10900	304	10600	280	0.00522	10	162	0.00901	0.2	0.00252	0	54.8
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	10900	305	10600	280	0.00512	10	162	0.00901	0.2	0.00252	0	54.8
280 SEMIFLUIDO CON RETARDANTE ECOPACT	10900	304	10600	280	0.00517	10	162	0.00901	0.2	0.00252	0	54.8
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	10900	306	10600	280	0.00519	10	162	0.00901	0.2	0.00252	0	54.8
280 SEMIFLUIDO CON FIBRA ECOPACT	11000	308	10700	283	0.00519	10	163	0.00909	0.205	0.00252	0	54.8
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	11000	309	10700	284	0.00528	10	163	0.00909	0.205	0.00252	0	54.8
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11000	307	10700	283	0.00509	10	163	0.00909	0.205	0.00252	0	54.8
280 SEMIFLUIDO 3/8 ECOPACT	11500	322	11200	297	0.00541	9.06	163	0.00929	0.2	0.00252	0	54.8
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	11600	324	11300	298	0.00553	9.07	164	0.00936	0.2	0.00252	0	54.8
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	11500	324	11200	296	0.00545	9.06	163	0.00929	0.2	0.00252	0	54.8
280 SEMIFLUIDO 3/8 CON	11700	325	11300	298	0.00546	9.07	164	0.00936	0.2	0.00252	0	54.8

RETARDANTE Y TEMPERATURA ECOPACT												
280 FLUIDO ECOPACT	11100	310	10800	286	0.00521	10.5	163	0.00915	0.2	0.00252	0	54.8
280 FLUIDO CON TEMPERATURA ECOPACT	11100	308	10800	285	0.00518	10.5	163	0.00915	0.2	0.00252	0	54.8
280 FLUIDO CON RETARDANTE ECOPACT	11300	311	10900	289	0.00519	10.5	164	0.00921	0.2	0.00252	0	54.8
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11200	313	11000	288	0.00529	10.5	164	0.00921	0.2	0.00252	0	54.8
280 FLUIDO CON FIBRA ECOPACT	11300	312	11000	289	0.00526	10.5	164	0.00921	0.205	0.00252	0	54.8
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	11300	311	10900	288	0.00529	10.5	164	0.00921	0.205	0.00252	0	54.8
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11200	314	10900	289	0.0053	10.5	164	0.00921	0.205	0.00252	0	54.8
280 FLUIDO 3/8 ECOPACT	11900	332	11600	307	0.0056	9.02	165	0.00951	0.2	0.00252	0	54.8
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	11900	337	11600	307	0.00576	9.02	165	0.00951	0.2	0.00252	0	54.8
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	12000	336	11600	307	0.00547	9.02	165	0.00951	0.2	0.00252	0	54.8
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	11900	336	11700	308	0.00571	9.02	165	0.00951	0.2	0.00252	0	54.8
280 LANZADO ECOPACT	12200	339	11800	313	0.0056	13.1	170	0.00987	0.2	0.00252	0	54.8

280 LANZADO CON TEMPERATURA ECOPACT	12100	334	11700	310	0.00564	11.8	166	0.00961	0.2	0.00252	0	54.8
300 BOMBA ECOPACT	12700	358	12300	326	0.006	7.2	169	0.00997	0.2	0.00252	0	54.8
300 BOMBA CON RETARDANTE ECOPACT	12700	363	12300	326	0.00594	7.2	169	0.00997	0.2	0.00252	0	54.8
300 BOMBA CON TEMPERATURA ECOPACT	12700	359	12400	327	0.006	7.2	169	0.00997	0.2	0.00252	0	54.8
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12700	362	12400	327	0.00596	7.2	169	0.00997	0.2	0.00252	0	54.8

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	0.316	745	7.98e-05	1.72	0.00468	11100
Maximum	139	0.328	789	8.41e-05	1.81	0.00497	11800
Mean	136	0.323	770	8.23e-05	1.77	0.00485	11500
Median	137	0.325	777	8.3e-05	1.79	0.00489	11600
350 BOMBA ECOPACT	137	0.325	777	8.3e-05	1.79	0.00489	11600
350 BOMBA CON RETARDANTE ECOPACT	137	0.325	777	8.3e-05	1.79	0.00489	11600
350 BOMBA CON TEMPERATURA ECOPACT	137	0.325	777	8.3e-05	1.79	0.00489	11600
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	137	0.325	777	8.3e-05	1.79	0.00489	11600
350 SEMIFLUIDO ECOPACT	132	0.316	746	7.99e-05	1.72	0.00468	11100

350 SEMIFLUIDO CON RETARDANTE ECOPACT	132	0.316	745	7.98e-05	1.72	0.00468	11100
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	132	0.316	745	7.98e-05	1.72	0.00468	11100
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	132	0.316	745	7.98e-05	1.72	0.00468	11100
350 FLUIDO ECOPACT	139	0.328	789	8.41e-05	1.81	0.00497	11800
350 FLUIDO CON RETARDANTE ECOPACT	139	0.328	789	8.41e-05	1.81	0.00497	11800
350 FLUIDO CON TEMPERATURA ECOPACT	139	0.328	789	8.41e-05	1.81	0.00497	11800
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	139	0.328	789	8.41e-05	1.81	0.00497	11800

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	349	12000	318	0.00573	7.72	167	0.00978	0.2	0.00252	0	54.8
Maximum	13200	371	12800	338	0.00626	7.9	171	0.0102	0.205	0.00252	0	54.8
Mean	12800	362	12500	329	0.00604	7.8	169	0.01	0.203	0.00252	0	54.8
Median	13000	366	12600	332	0.0061	7.83	170	0.0101	0.205	0.00252	0	54.8
350 BOMBA ECOPACT	12900	365	12600	332	0.00611	7.72	170	0.0101	0.2	0.00252	0	54.8
350 BOMBA CON RETARDANTE ECOPACT	13000	367	12600	332	0.00619	7.72	170	0.0101	0.2	0.00252	0	54.8
350 BOMBA CON TEMPERATURA ECOPACT	13000	366	12600	332	0.00603	7.72	170	0.0101	0.2	0.00252	0	54.8
350 BOMBA CON RETARDANTE Y	12900	362	12600	331	0.00608	7.72	170	0.0101	0.2	0.00252	0	54.8

TEMPERATURA ECOPACT												
350 SEMIFLUIDO ECOPACT	12400	351	12100	318	0.00582	7.9	168	0.0098	0.205	0.00252	0	54.8
350 SEMIFLUIDO CON RETARDANTE ECOPACT	12400	353	12100	318	0.00596	7.86	167	0.00979	0.205	0.00252	0	54.8
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	12400	349	12000	318	0.00573	7.86	167	0.00979	0.205	0.00252	0	54.8
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12400	349	12000	318	0.00578	7.77	167	0.00978	0.205	0.00252	0	54.8
350 FLUIDO ECOPACT	13100	370	12800	338	0.00618	7.83	171	0.0102	0.205	0.00252	0	54.8
350 FLUIDO CON RETARDANTE ECOPACT	13200	370	12700	337	0.00619	7.83	171	0.0102	0.205	0.00252	0	54.8
350 FLUIDO CON TEMPERATURA ECOPACT	13200	367	12700	338	0.00626	7.83	171	0.0102	0.205	0.00252	0	54.8
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	13100	371	12800	337	0.00612	7.83	171	0.0102	0.205	0.00252	0	54.8

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	0.314	740	7.94e-05	1.71	0.00464	11100

Maximum	134	0.32	758	8.12e-05	1.75	0.00476	11300
Mean	133	0.318	752	8.06e-05	1.74	0.00472	11200
Median	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 BOMBA ECOPACT	131	0.314	740	7.94e-05	1.71	0.00464	11100
420 BOMBA CON RETARDANTE ECOPACT	131	0.314	740	7.94e-05	1.71	0.00464	11100
420 BOMBA CON TEMPERATURA ECOPACT	131	0.314	740	7.94e-05	1.71	0.00464	11100
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	131	0.314	740	7.94e-05	1.71	0.00464	11100
420 SEMIFLUIDO ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 SEMIFLUIDO CON RETARDANTE ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 FLUIDO ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 FLUIDO CON RETARDANTE ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 FLUIDO CON TEMPERATURA ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	134	0.32	758	8.12e-05	1.75	0.00476	11300

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	12300	345	11900	316	0.00578	7.91	167	0.00977	0.2	0.00252	0	54.8
Maximum	12700	356	12300	325	0.00601	7.98	169	0.00994	0.2	0.00252	0	54.8

Mean	12500	352	12200	321	0.00593	7.93	168	0.00988	0.2	0.00252	0	54.8
Median	12600	353	12200	324	0.00595	7.91	169	0.00994	0.2	0.00252	0	54.8
420 BOMBA ECOPACT	12300	350	12000	316	0.00578	7.98	167	0.00977	0.2	0.00252	0	54.8
420 BOMBA CON RETARDANTE ECOPACT	12300	345	11900	317	0.00594	7.98	167	0.00977	0.2	0.00252	0	54.8
420 BOMBA CON TEMPERATURA ECOPACT	12300	347	11900	316	0.00578	7.98	167	0.00977	0.2	0.00252	0	54.8
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12300	347	12000	316	0.00584	7.98	167	0.00977	0.2	0.00252	0	54.8
420 SEMIFLUIDO ECOPACT	12600	353	12300	323	0.00595	7.91	169	0.00994	0.2	0.00252	0	54.8
420 SEMIFLUIDO CON RETARDANTE ECOPACT	12600	356	12200	324	0.00595	7.91	169	0.00994	0.2	0.00252	0	54.8
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	12600	353	12300	325	0.006	7.91	169	0.00994	0.2	0.00252	0	54.8
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12700	355	12300	324	0.00601	7.91	169	0.00994	0.2	0.00252	0	54.8
420 FLUIDO ECOPACT	12600	356	12300	324	0.00593	7.91	169	0.00994	0.2	0.00252	0	54.8
420 FLUIDO CON RETARDANTE ECOPACT	12600	354	12300	324	0.00599	7.91	169	0.00994	0.2	0.00252	0	54.8
420 FLUIDO CON TEMPERATURA ECOPACT	12600	353	12300	324	0.006	7.91	169	0.00994	0.2	0.00252	0	54.8
420 FLUIDO CON	12600	356	12200	323	0.00595	7.91	169	0.00994	0.2	0.00252	0	54.8

RETARDANTE Y TEMPERATURA ECOPACT												

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.