ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT KM28 EL CHAPARRAL II** facility in San Miguel, 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:	30 May 2023
Period of Validity:	5 years; valid until 30 May 2028
EPD Number:	D72a864f-834c-42a8-9241-bab0ceac6c31

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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 28 concrete facility in San Salvador, 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:

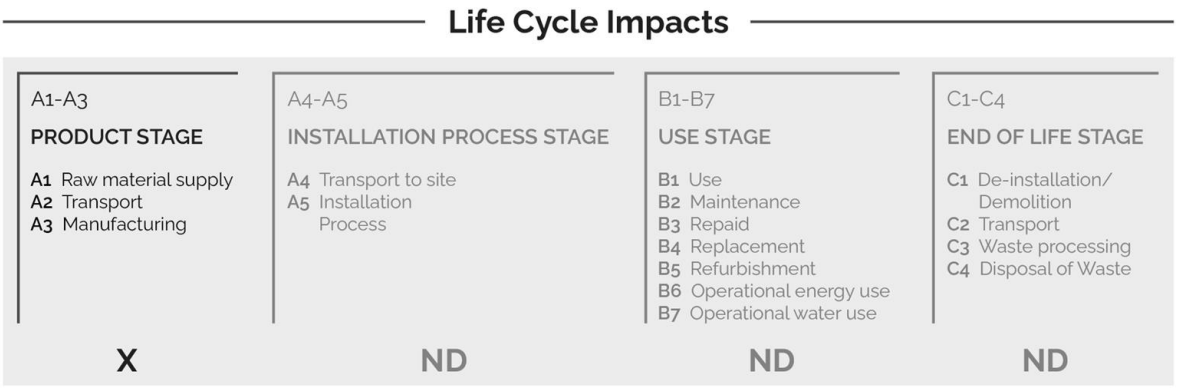

Figure 1: **General life cycle phases for consideration in a construction works system.**

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.

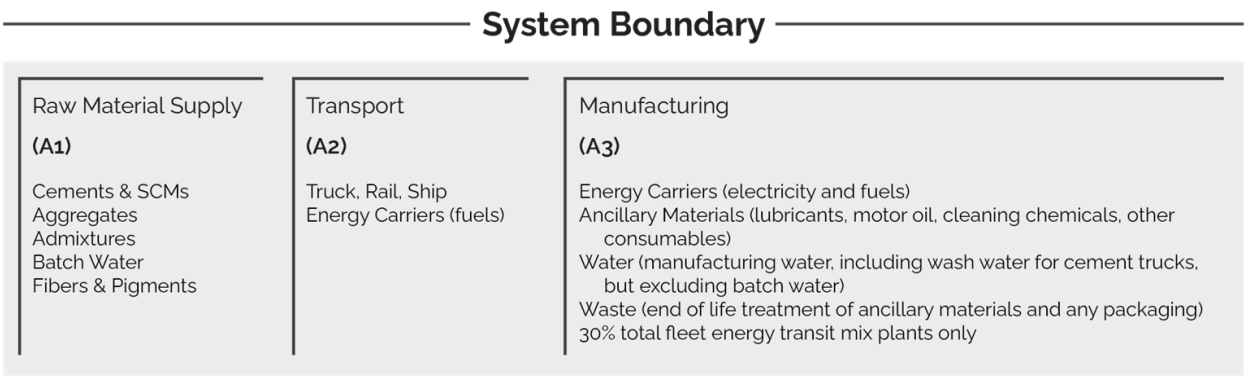

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

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 28 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	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	66.8	0.114	348	3.83e-05	0.9	0.00225	5400
Maximum	75.4	0.128	392	4.28e-05	1.01	0.00255	6090
Mean	71	0.121	369	4.05e-05	0.954	0.00239	5730
Median	70.2	0.119	362	3.98e-05	0.946	0.00234	5620
100 BOMBA ECOPACT	66.8	0.114	348	3.83e-05	0.9	0.00225	5400
100 BOMBA CON TEMPERATURA ECOPACT	66.8	0.114	348	3.83e-05	0.9	0.00225	5400
100 BOMBA CON RETARDANTE ECOPACT	66.8	0.114	348	3.83e-05	0.9	0.00225	5400
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	66.8	0.114	348	3.83e-05	0.9	0.00225	5400
100 BOMBA CON FIBRA ECOPACT	69.1	0.117	361	3.97e-05	0.929	0.00234	5610

100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	69.1	0.117	361	3.97e-05	0.929	0.00234	5610
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	69.1	0.117	361	3.97e-05	0.929	0.00234	5610
100 DIRECTO ECOPACT	67.7	0.115	348	3.84e-05	0.914	0.00226	5400
100 DIRECTO CON TEMPERATURA ECOPACT	67.7	0.115	348	3.84e-05	0.914	0.00226	5400
100 DIRECTO CON RETARDANTE ECOPACT	70.1	0.119	362	3.98e-05	0.945	0.00234	5610
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	70.1	0.119	362	3.98e-05	0.945	0.00234	5610
100 DIRECTO CON FIBRA ECOPACT	70.2	0.119	362	3.98e-05	0.946	0.00235	5620
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	70.2	0.119	362	3.98e-05	0.946	0.00235	5620
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	70.2	0.119	362	3.98e-05	0.946	0.00235	5620
140 DIRECTO ECOPACT	74.9	0.127	392	4.27e-05	1	0.00255	6080
140 DIRECTO CON RETARDANTE ECOPACT	74.9	0.127	392	4.27e-05	1	0.00255	6080
140 DIRECTO CON TEMPERATURA ECOPACT	74.9	0.127	392	4.27e-05	1	0.00255	6080
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	74.9	0.127	392	4.27e-05	1	0.00255	6080
140 BOMBA ECOPACT	75.4	0.128	392	4.28e-05	1.01	0.00255	6090
140 BOMBA CON RETARDANTE ECOPACT	75.4	0.128	392	4.28e-05	1.01	0.00255	6090
140 BOMBA CON TEMPERATURA ECOPACT	75.4	0.128	392	4.28e-05	1.01	0.00255	6090
140 BOMBA CON RETARDANTE Y	75.4	0.128	392	4.28e-05	1.01	0.00255	6090

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	6000	166	5830	154	0.00278	10.5	47.5	0.00465	0.178	0.00192	0	1.19
Maximum	6800	193	6620	174	0.0032	11.9	51.4	0.00512	0.189	0.00192	0	1.19
Mean	6390	178	6200	164	0.003	11.4	49.4	0.00488	0.185	0.00192	0	1.19
Median	6270	174	6080	160	0.00296	11.8	49	0.00482	0.184	0.00192	0	1.19
100 BOMBA ECOPACT	6040	168	5830	154	0.00278	11.9	47.5	0.00465	0.184	0.00192	0	1.19
100 BOMBA CON TEMPERATURA ECOPACT	6030	166	5850	154	0.00281	11.9	47.5	0.00465	0.184	0.00192	0	1.19
100 BOMBA CON RETARDANTE ECOPACT	6010	167	5850	154	0.00283	11.9	47.5	0.00465	0.184	0.00192	0	1.19
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	6000	168	5860	155	0.00288	11.9	47.5	0.00465	0.184	0.00192	0	1.19
100 BOMBA CON FIBRA ECOPACT	6270	173	6060	160	0.00295	11.9	48.8	0.0048	0.189	0.00192	0	1.19
100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	6260	174	6080	160	0.00296	11.9	48.8	0.0048	0.189	0.00192	0	1.19
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	6270	173	6080	160	0.00294	11.9	48.8	0.0048	0.189	0.00192	0	1.19
100 DIRECTO ECOPACT	6010	167	5850	154	0.00283	11.3	47.6	0.00465	0.178	0.00192	0	1.19
100 DIRECTO CON TEMPERATURA ECOPACT	6020	167	5870	155	0.00282	11.3	47.6	0.00465	0.178	0.00192	0	1.19

100 DIRECTO CON RETARDANTE ECOPACT	6250	173	6060	161	0.00294	11.8	49	0.00482	0.178	0.00192	0	1.19
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	6260	174	6080	161	0.00291	11.8	49	0.00482	0.178	0.00192	0	1.19
100 DIRECTO CON FIBRA ECOPACT	6280	173	6080	161	0.00296	11.8	49.1	0.00483	0.189	0.00192	0	1.19
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	6250	173	6090	160	0.00297	11.8	49.1	0.00483	0.184	0.00192	0	1.19
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	6270	175	6080	160	0.00297	11.8	49.1	0.00483	0.189	0.00192	0	1.19
140 DIRECTO ECOPACT	6760	193	6590	174	0.00318	10.5	51.1	0.00509	0.184	0.00192	0	1.19
140 DIRECTO CON RETARDANTE ECOPACT	6780	189	6570	174	0.00315	10.5	51.1	0.00509	0.184	0.00192	0	1.19
140 DIRECTO CON TEMPERATURA ECOPACT	6780	189	6570	174	0.0032	10.5	51.1	0.00509	0.184	0.00192	0	1.19
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	6800	189	6620	174	0.00314	10.5	51.1	0.00509	0.184	0.00192	0	1.19
140 BOMBA ECOPACT	6790	189	6600	174	0.00316	10.8	51.4	0.00512	0.189	0.00192	0	1.19
140 BOMBA CON RETARDANTE ECOPACT	6770	189	6610	174	0.00318	10.8	51.4	0.00512	0.189	0.00192	0	1.19
140 BOMBA CON TEMPERATURA ECOPACT	6780	190	6610	174	0.00316	10.8	51.4	0.00512	0.189	0.00192	0	1.19
140 BOMBA CON RETARDANTE Y	6800	190	6600	174	0.00319	10.8	51.4	0.00512	0.189	0.00192	0	1.19

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	78.4	0.133	411	4.47e-05	1.05	0.00268	6390
Maximum	81.4	0.137	425	4.61e-05	1.09	0.00277	6600
Mean	79.9	0.135	418	4.54e-05	1.07	0.00272	6490
Median	80.2	0.135	418	4.54e-05	1.07	0.00272	6490
180 BOMBA ECOPACT	78.6	0.133	412	4.48e-05	1.05	0.00268	6390
180 BOMBA CON TEMPERATURA ECOPACT	78.6	0.133	412	4.48e-05	1.05	0.00268	6390
180 BOMBA CON RETARDANTE ECOPACT	78.5	0.133	411	4.47e-05	1.05	0.00268	6390
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	78.4	0.133	411	4.47e-05	1.05	0.00268	6390
180 BOMBA CON FIBRA ECOPACT	80.7	0.137	424	4.6e-05	1.08	0.00277	6590
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	80.7	0.137	424	4.6e-05	1.08	0.00277	6590
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	80.7	0.137	424	4.6e-05	1.08	0.00277	6590
180 DIRECTO ECOPACT	79.2	0.134	412	4.48e-05	1.06	0.00268	6400
180 DIRECTO CON TEMPERATURA ECOPACT	79.2	0.134	412	4.48e-05	1.06	0.00268	6400
180 DIRECTO CON RETARDANTE ECOPACT	80.2	0.135	418	4.54e-05	1.07	0.00272	6490
180 DIRECTO CON RETARDANTE Y	80.2	0.135	418	4.54e-05	1.07	0.00272	6490

TEMPERATURA ECOPACT							
180 DIRECTO CON FIBRA ECOPACT	81.4	0.137	425	4.61e-05	1.09	0.00277	6600
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	81.4	0.137	425	4.61e-05	1.09	0.00277	6600
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	81.4	0.137	425	4.61e-05	1.09	0.00277	6600

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	7110	199	6900	182	0.00331	10.2	53	0.00531	0.178	0.00192	0	1.19
Maximum	7370	207	7160	189	0.00351	10.9	54.4	0.00548	0.189	0.00192	0	1.19
Mean	7240	203	7030	186	0.0034	10.5	53.7	0.0054	0.184	0.00192	0	1.19
Median	7240	203	7030	186	0.00338	10.4	53.7	0.0054	0.184	0.00192	0	1.19
180 BOMBA ECOPACT	7130	201	6920	183	0.00334	10.9	53.2	0.00533	0.184	0.00192	0	1.19
180 BOMBA CON TEMPERATURA ECOPACT	7120	200	6930	183	0.00337	10.9	53.2	0.00533	0.184	0.00192	0	1.19
180 BOMBA CON RETARDANTE ECOPACT	7110	201	6920	182	0.00332	10.7	53.1	0.00532	0.184	0.00192	0	1.19
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7140	199	6900	183	0.00337	10.5	53	0.00531	0.184	0.00192	0	1.19
180 BOMBA CON FIBRA ECOPACT	7350	207	7130	189	0.00345	10.6	54.3	0.00547	0.189	0.00192	0	1.19
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	7330	205	7140	189	0.00351	10.6	54.3	0.00547	0.189	0.00192	0	1.19

180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	7350	205	7160	189	0.00346	10.6	54.3	0.00547	0.189	0.00192	0	1.19
180 DIRECTO ECOPACT	7150	199	6900	183	0.00338	10.3	53.2	0.00534	0.178	0.00192	0	1.19
180 DIRECTO CON TEMPERATURA ECOPACT	7150	200	6940	184	0.0033	10.3	53.2	0.00534	0.178	0.00192	0	1.19
180 DIRECTO CON RETARDANTE ECOPACT	7250	203	7040	186	0.00339	10.2	53.7	0.0054	0.178	0.00192	0	1.19
180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7230	203	7020	186	0.00343	10.2	53.7	0.0054	0.178	0.00192	0	1.19
180 DIRECTO CON FIBRA ECOPACT	7370	205	7140	188	0.00349	10.2	54.4	0.00548	0.189	0.00192	0	1.19
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	7350	207	7160	189	0.00337	10.2	54.4	0.00548	0.189	0.00192	0	1.19
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	7350	205	7120	189	0.00346	10.2	54.4	0.00548	0.189	0.00192	0	1.19

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	89.2	0.151	474	5.11e-05	1.18	0.0031	7370
Maximum	124	0.207	649	6.81e-05	1.64	0.0043	10100
Mean	96.3	0.163	516	5.54e-05	1.27	0.00338	8040
Median	95	0.161	506	5.43e-05	1.26	0.00332	7880
210 DIRECTO ECOPACT	92.8	0.156	487	5.24e-05	1.23	0.00319	7580

210 DIRECTO CON TEMPERATURA ECOPACT	92.8	0.156	487	5.24e-05	1.23	0.00319	7580
210 DIRECTO CON RETARDANTE ECOPACT	92.8	0.156	487	5.24e-05	1.23	0.00319	7580
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	92.8	0.156	487	5.24e-05	1.23	0.00319	7580
210 DIRECTO CON FIBRA ECOPACT	95	0.16	500	5.36e-05	1.26	0.00328	7780
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	95	0.16	500	5.36e-05	1.26	0.00328	7780
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	95	0.16	500	5.36e-05	1.26	0.00328	7780
210 BOMBA ECOPACT	89.8	0.152	474	5.11e-05	1.19	0.0031	7380
210 BOMBA CON TEMPERATURA ECOPACT	89.8	0.152	474	5.11e-05	1.19	0.0031	7380
210 BOMBA CON RETARDANTE ECOPACT	89.3	0.151	474	5.11e-05	1.18	0.0031	7380
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	89.3	0.151	474	5.11e-05	1.18	0.0031	7380
210 BOMBA CON FIBRA ECOPACT	92.1	0.156	487	5.24e-05	1.22	0.00319	7580
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	91.5	0.155	487	5.24e-05	1.21	0.00319	7580
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	92.1	0.156	487	5.24e-05	1.22	0.00319	7580
210 BOMBA PP ECOPACT	89.2	0.151	474	5.11e-05	1.18	0.0031	7370
210 BOMBA PP CON TEMPERATURA ECOPACT	89.2	0.151	474	5.11e-05	1.18	0.0031	7370
210 SEMIFLUIDO ECOPACT	94.7	0.16	506	5.42e-05	1.25	0.00331	7870
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	94.7	0.16	506	5.42e-05	1.25	0.00331	7870

210 SEMIFLUIDO CON RETARDANTE ECOPACT	94.7	0.16	506	5.42e-05	1.25	0.00331	7870
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	94.7	0.16	506	5.42e-05	1.25	0.00331	7870
210 SEMIFLUIDO CON FIBRA ECOPACT	95.1	0.161	506	5.43e-05	1.26	0.00332	7880
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	95.1	0.161	506	5.43e-05	1.26	0.00332	7880
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	95.1	0.161	506	5.43e-05	1.26	0.00332	7880
210 SEMIFLUIDO 3/8 ECOPACT	99.9	0.171	549	5.87e-05	1.31	0.00359	8550
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	101	0.172	556	5.94e-05	1.32	0.00363	8650
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	99.9	0.171	549	5.87e-05	1.31	0.00359	8550
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	101	0.172	556	5.94e-05	1.32	0.00363	8650
210 FLUIDO ECOPACT	94.8	0.161	512	5.5e-05	1.25	0.00334	7970
210 FLUIDO CON TEMPERATURA ECOPACT	94.8	0.161	512	5.5e-05	1.25	0.00334	7970
210 FLUIDO CON RETARDANTE ECOPACT	94.8	0.161	512	5.5e-05	1.25	0.00334	7970
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	94.8	0.161	512	5.5e-05	1.25	0.00334	7970
210 FLUIDO CON FIBRA ECOPACT	96	0.163	519	5.57e-05	1.27	0.00339	8080
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	96	0.163	519	5.57e-05	1.27	0.00339	8080
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	96	0.163	519	5.57e-05	1.27	0.00339	8080

210 FLUIDO 3/8 ECOPACT	103	0.176	568	6.06e-05	1.35	0.00371	8850
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	103	0.176	568	6.06e-05	1.35	0.00371	8850
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	103	0.176	568	6.06e-05	1.35	0.00371	8850
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	103	0.176	568	6.06e-05	1.35	0.00371	8850
210 LANZADO ECOPACT	103	0.177	575	6.14e-05	1.35	0.00375	8950
210 LANZADO CON TEMPERATURA ECOPACT	103	0.177	575	6.14e-05	1.35	0.00375	8950
210 PERMEABLE ECOPACT	124	0.207	649	6.81e-05	1.64	0.0043	10100
245 DIRECTO ECOPACT	97.3	0.164	512	5.48e-05	1.29	0.00336	7970
245 BOMBA ECOPACT	97.4	0.165	518	5.55e-05	1.29	0.00339	8070
250 DIRECTO ECOPACT	97.3	0.164	512	5.48e-05	1.29	0.00336	7970
250 BOMBA ECOPACT	97.4	0.165	518	5.55e-05	1.29	0.00339	8070

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	8200	230	7980	210	0.00384	0.965	58.6	0.00599	0.105	0.00192	0	1.19
Maximum	11300	323	10900	289	0.0053	12.5	72.8	0.00775	0.205	0.00192	0	1.19
Mean	8960	252	8710	230	0.00421	10.1	62.4	0.00645	0.189	0.00192	0	1.19
Median	8810	248	8550	226	0.00415	9.84	61.6	0.00635	0.189	0.00192	0	1.19
210 DIRECTO ECOPACT	8470	238	8260	217	0.00398	9.07	59.8	0.00614	0.178	0.00192	0	1.19
210 DIRECTO CON TEMPERATURA ECOPACT	8440	239	8190	217	0.00399	9.07	59.8	0.00614	0.178	0.00192	0	1.19
210 DIRECTO CON	8420	237	8210	217	0.00398	9.07	59.8	0.00614	0.178	0.00192	0	1.19

RETARDANTE ECOPACT												
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	8430	237	8230	217	0.00402	9.07	59.8	0.00614	0.178	0.00192	0	1.19
210 DIRECTO CON FIBRA ECOPACT	8670	245	8440	223	0.00406	8.88	61	0.00628	0.189	0.00192	0	1.19
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	8660	244	8440	222	0.00408	8.88	61	0.00628	0.189	0.00192	0	1.19
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	8640	245	8410	223	0.00409	8.88	61	0.00628	0.189	0.00192	0	1.19
210 BOMBA ECOPACT	8250	231	8010	210	0.00388	9.73	58.6	0.006	0.184	0.00192	0	1.19
210 BOMBA CON TEMPERATURA ECOPACT	8230	232	7980	211	0.00388	9.73	58.6	0.006	0.184	0.00192	0	1.19
210 BOMBA CON RETARDANTE ECOPACT	8230	231	7980	211	0.00384	10.3	58.7	0.006	0.189	0.00192	0	1.19
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	8220	233	8030	211	0.00388	10.3	58.7	0.006	0.189	0.00192	0	1.19
210 BOMBA CON FIBRA ECOPACT	8450	236	8240	217	0.00397	9.76	59.9	0.00615	0.189	0.00192	0	1.19
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	8450	239	8150	217	0.00405	10.4	60	0.00615	0.189	0.00192	0	1.19
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	8480	237	8220	217	0.00398	9.76	59.9	0.00615	0.189	0.00192	0	1.19
210 BOMBA PP ECOPACT	8200	230	8000	212	0.00393	10.2	58.6	0.00599	0.184	0.00192	0	1.19
210 BOMBA PP CON	8230	232	7990	211	0.00387	10.2	58.6	0.00599	0.184	0.00192	0	1.19

TEMPERATURA ECOPACT												
210 SEMIFLUIDO ECOPACT	8760	246	8510	224	0.00405	9.82	61.3	0.00633	0.189	0.00192	0	1.19
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	8780	246	8510	225	0.00411	9.82	61.3	0.00633	0.189	0.00192	0	1.19
210 SEMIFLUIDO CON RETARDANTE ECOPACT	8760	248	8540	225	0.00415	9.82	61.3	0.00633	0.189	0.00192	0	1.19
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	8810	247	8520	225	0.00407	9.82	61.3	0.00633	0.189	0.00192	0	1.19
210 SEMIFLUIDO CON FIBRA ECOPACT	8780	247	8550	226	0.00416	9.84	61.6	0.00635	0.2	0.00192	0	1.19
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	8760	247	8520	225	0.00418	9.84	61.6	0.00635	0.2	0.00192	0	1.19
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	8800	249	8550	225	0.00422	9.84	61.6	0.00635	0.2	0.00192	0	1.19
210 SEMIFLUIDO 3/8 ECOPACT	9530	265	9250	245	0.00448	11.5	65.1	0.00679	0.2	0.00192	0	1.19
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	9640	271	9370	248	0.00446	11.6	65.7	0.00686	0.2	0.00192	0	1.19
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	9530	265	9280	245	0.00447	11.5	65.1	0.00679	0.2	0.00192	0	1.19

210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	9640	270	9380	248	0.00446	11.6	65.7	0.00686	0.2	0.00192	0	1.19
210 FLUIDO ECOPACT	8870	248	8650	229	0.00411	11.3	62.1	0.00642	0.194	0.00192	0	1.19
210 FLUIDO CON TEMPERATURA ECOPACT	8910	246	8650	228	0.00415	11.3	62.1	0.00642	0.194	0.00192	0	1.19
210 FLUIDO CON RETARDANTE ECOPACT	8890	249	8650	228	0.0041	11.3	62.1	0.00642	0.194	0.00192	0	1.19
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	8880	249	8630	229	0.00423	11.3	62.1	0.00642	0.194	0.00192	0	1.19
210 FLUIDO CON FIBRA ECOPACT	9010	253	8740	231	0.0042	11.3	62.8	0.0065	0.194	0.00192	0	1.19
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	8990	252	8720	231	0.00421	11.3	62.8	0.0065	0.194	0.00192	0	1.19
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	8990	253	8740	231	0.00425	11.3	62.8	0.0065	0.194	0.00192	0	1.19
210 FLUIDO 3/8 ECOPACT	9860	275	9570	253	0.00468	11.6	66.8	0.00699	0.205	0.00192	0	1.19
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	9920	275	9580	254	0.00461	11.6	66.8	0.00699	0.205	0.00192	0	1.19
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	9860	276	9600	253	0.0046	11.6	66.8	0.00699	0.205	0.00192	0	1.19
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	9870	275	9610	253	0.00458	11.6	66.8	0.00699	0.205	0.00192	0	1.19

210 LANZADO ECOPACT	9990	281	9710	256	0.0047	12.5	67.5	0.00707	0.184	0.00192	0	1.19
210 LANZADO CON TEMPERATURA ECOPACT	9980	282	9690	255	0.00466	12.5	67.5	0.00707	0.184	0.00192	0	1.19
210 PERMEABLE ECOPACT	11300	323	10900	289	0.0053	0.965	72.8	0.00775	0.105	0.00192	0	1.19
245 DIRECTO ECOPACT	8880	252	8630	228	0.00416	8.29	61.9	0.00639	0.184	0.00192	0	1.19
245 BOMBA ECOPACT	8990	254	8750	231	0.00425	9.24	62.4	0.00646	0.189	0.00192	0	1.19
250 DIRECTO ECOPACT	8870	249	8620	228	0.0042	8.29	61.9	0.00639	0.184	0.00192	0	1.19
250 BOMBA ECOPACT	8990	255	8710	231	0.00418	9.24	62.4	0.00646	0.189	0.00192	0	1.19

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	105	0.177	556	5.92e-05	1.39	0.00365	8660
Maximum	128	0.217	695	7.33e-05	1.68	0.00458	10800
Mean	112	0.19	608	6.46e-05	1.48	0.00399	9460
Median	110	0.186	595	6.33e-05	1.44	0.0039	9260
280 DIRECTO ECOPACT	105	0.177	556	5.92e-05	1.39	0.00365	8660
280 DIRECTO CON TEMPERATURA ECOPACT	105	0.177	556	5.92e-05	1.39	0.00365	8660
280 DIRECTO CON RETARDANTE ECOPACT	105	0.177	556	5.92e-05	1.39	0.00365	8660
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	105	0.177	556	5.92e-05	1.39	0.00365	8660
280 DIRECTO CON FIBRA ECOPACT	106	0.179	563	5.99e-05	1.4	0.0037	8760

280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	106	0.179	563	5.99e-05	1.4	0.0037	8760
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	106	0.179	563	5.99e-05	1.4	0.0037	8760
280 BOMBA ECOPACT	109	0.184	581	6.18e-05	1.43	0.00382	9050
280 BOMBA CON TEMPERATURA ECOPACT	109	0.184	581	6.18e-05	1.43	0.00382	9050
280 BOMBA CON RETARDANTE ECOPACT	109	0.184	581	6.18e-05	1.43	0.00382	9050
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	109	0.184	581	6.18e-05	1.43	0.00382	9050
280 BOMBA CON FIBRA ECOPACT	110	0.186	588	6.25e-05	1.45	0.00387	9160
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	110	0.186	588	6.25e-05	1.45	0.00387	9160
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	110	0.186	588	6.25e-05	1.45	0.00387	9160
280 BOMBA PP ECOPACT	108	0.183	581	6.19e-05	1.42	0.00381	9050
280 BOMBA PP CON TEMPERATURA ECOPACT	108	0.183	581	6.19e-05	1.42	0.00381	9050
280 SEMIFLUIDO ECOPACT	108	0.184	588	6.26e-05	1.42	0.00385	9150
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	108	0.184	588	6.26e-05	1.42	0.00385	9150
280 SEMIFLUIDO CON RETARDANTE ECOPACT	108	0.184	588	6.26e-05	1.42	0.00385	9150
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	108	0.184	588	6.26e-05	1.42	0.00385	9150
280 SEMIFLUIDO CON FIBRA ECOPACT	110	0.186	595	6.33e-05	1.44	0.0039	9260
280 SEMIFLUIDO CON FIBRA Y	110	0.186	595	6.33e-05	1.44	0.0039	9260

RETARDANTE ECOPACT							
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	110	0.186	595	6.33e-05	1.44	0.0039	9260
280 SEMIFLUIDO 3/8 ECOPACT	115	0.195	625	6.63e-05	1.51	0.0041	9740
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	116	0.197	632	6.69e-05	1.52	0.00415	9840
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	115	0.195	625	6.63e-05	1.51	0.0041	9740
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	116	0.197	632	6.69e-05	1.52	0.00415	9840
280 FLUIDO ECOPACT	110	0.187	601	6.39e-05	1.44	0.00393	9350
280 FLUIDO CON TEMPERATURA ECOPACT	110	0.187	601	6.39e-05	1.44	0.00393	9350
280 FLUIDO CON RETARDANTE ECOPACT	111	0.189	607	6.46e-05	1.46	0.00398	9450
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.189	607	6.46e-05	1.46	0.00398	9450
280 FLUIDO CON FIBRA ECOPACT	111	0.189	607	6.46e-05	1.46	0.00398	9460
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	111	0.189	607	6.46e-05	1.46	0.00398	9460
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	111	0.189	607	6.46e-05	1.46	0.00398	9460
280 FLUIDO 3/8 ECOPACT	119	0.202	650	6.88e-05	1.56	0.00427	10100
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	119	0.202	650	6.88e-05	1.56	0.00427	10100
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	119	0.202	650	6.88e-05	1.56	0.00427	10100
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	119	0.202	650	6.88e-05	1.56	0.00427	10100

280 LANZADO ECOPACT	118	0.202	659	7e-05	1.54	0.00431	10300
280 LANZADO CON TEMPERATURA ECOPACT	118	0.201	657	6.97e-05	1.53	0.0043	10200
300 BOMBA ECOPACT	128	0.217	695	7.33e-05	1.68	0.00458	10800
300 BOMBA CON RETARDANTE ECOPACT	128	0.217	695	7.33e-05	1.68	0.00458	10800
300 BOMBA CON TEMPERATURA ECOPACT	128	0.217	695	7.33e-05	1.68	0.00458	10800
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	128	0.217	695	7.33e-05	1.68	0.00458	10800

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	9650	271	9360	247	0.00448	7.13	65.7	0.00686	0.184	0.00192	0	1.19
Maximum	12100	345	11800	310	0.00581	13	77.9	0.00834	0.205	0.00192	0	1.19
Mean	10600	298	10300	271	0.00497	8.99	70.4	0.00742	0.198	0.00192	0	1.19
Median	10400	291	10000	265	0.00486	8.96	69.4	0.0073	0.2	0.00192	0	1.19
280 DIRECTO ECOPACT	9650	271	9400	248	0.00448	7.58	65.7	0.00686	0.184	0.00192	0	1.19
280 DIRECTO CON TEMPERATURA ECOPACT	9700	273	9360	247	0.0046	7.58	65.7	0.00686	0.184	0.00192	0	1.19
280 DIRECTO CON RETARDANTE ECOPACT	9650	273	9360	248	0.00454	7.58	65.7	0.00686	0.184	0.00192	0	1.19
280 DIRECTO CON RETARDANTE Y	9660	273	9390	247	0.00453	7.58	65.7	0.00686	0.184	0.00192	0	1.19

TEMPERATURA ECOPACT												
280 DIRECTO CON FIBRA ECOPACT	9760	274	9470	250	0.00458	7.6	66.4	0.00694	0.189	0.00192	0	1.19
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	9800	279	9530	250	0.00456	7.6	66.4	0.00694	0.189	0.00192	0	1.19
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	9770	278	9490	251	0.00475	7.6	66.4	0.00694	0.189	0.00192	0	1.19
280 BOMBA ECOPACT	10100	285	9830	260	0.0048	8.14	67.9	0.00713	0.2	0.00192	0	1.19
280 BOMBA CON TEMPERATURA ECOPACT	10100	287	9860	259	0.00477	8.14	67.9	0.00713	0.2	0.00192	0	1.19
280 BOMBA CON RETARDANTE ECOPACT	10100	288	9790	258	0.00481	8.13	67.9	0.00713	0.194	0.00192	0	1.19
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10100	284	9800	259	0.00476	8.13	67.9	0.00713	0.194	0.00192	0	1.19
280 BOMBA CON FIBRA ECOPACT	10200	290	9940	262	0.00475	8.15	68.6	0.00721	0.2	0.00192	0	1.19
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	10200	289	9950	262	0.0048	8.15	68.6	0.00721	0.2	0.00192	0	1.19
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	10200	290	9940	261	0.00478	8.15	68.6	0.00721	0.2	0.00192	0	1.19
280 BOMBA PP ECOPACT	10100	284	9810	259	0.00479	8.99	68	0.00713	0.2	0.00192	0	1.19
280 BOMBA PP CON TEMPERATURA ECOPACT	10100	282	9790	260	0.0047	8.99	68	0.00713	0.2	0.00192	0	1.19

280 SEMIFLUIDO ECOPACT	10200	289	9910	262	0.00474	9.93	68.7	0.00721	0.2	0.00192	0	1.19
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	10200	287	9930	262	0.00486	9.93	68.7	0.00721	0.2	0.00192	0	1.19
280 SEMIFLUIDO CON RETARDANTE ECOPACT	10200	289	9870	262	0.00477	9.93	68.7	0.00721	0.2	0.00192	0	1.19
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	10200	286	9940	262	0.00476	9.93	68.7	0.00721	0.2	0.00192	0	1.19
280 SEMIFLUIDO CON FIBRA ECOPACT	10300	290	10000	265	0.00479	9.95	69.4	0.0073	0.205	0.00192	0	1.19
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	10400	290	10000	265	0.00475	9.95	69.4	0.0073	0.205	0.00192	0	1.19
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	10300	293	10000	265	0.0049	9.95	69.4	0.0073	0.205	0.00192	0	1.19
280 SEMIFLUIDO 3/8 ECOPACT	10900	306	10500	280	0.0052	8.99	71.7	0.0076	0.2	0.00192	0	1.19
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	11000	312	10700	281	0.00517	9	72.3	0.00767	0.2	0.00192	0	1.19
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	10900	304	10500	278	0.0052	8.99	71.7	0.0076	0.2	0.00192	0	1.19
280 SEMIFLUIDO 3/8 CON	11000	310	10700	282	0.00513	9	72.3	0.00767	0.2	0.00192	0	1.19

RETARDANTE Y TEMPERATURA ECOPACT												
280 FLUIDO ECOPACT	10400	292	10100	268	0.00487	10.4	69.8	0.00736	0.2	0.00192	0	1.19
280 FLUIDO CON TEMPERATURA ECOPACT	10400	294	10100	267	0.00495	10.4	69.8	0.00736	0.2	0.00192	0	1.19
280 FLUIDO CON RETARDANTE ECOPACT	10500	295	10300	271	0.005	10.4	70.4	0.00743	0.2	0.00192	0	1.19
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	10500	298	10200	271	0.00502	10.4	70.4	0.00743	0.2	0.00192	0	1.19
280 FLUIDO CON FIBRA ECOPACT	10500	296	10200	271	0.00501	10.4	70.5	0.00743	0.205	0.00192	0	1.19
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	10500	297	10300	271	0.00487	10.4	70.5	0.00743	0.205	0.00192	0	1.19
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	10600	293	10200	270	0.00501	10.4	70.5	0.00743	0.205	0.00192	0	1.19
280 FLUIDO 3/8 ECOPACT	11300	318	11000	291	0.00526	8.94	73.9	0.00786	0.2	0.00192	0	1.19
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	11300	319	11000	290	0.00526	8.94	73.9	0.00786	0.2	0.00192	0	1.19
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	11300	320	11000	290	0.00535	8.94	73.9	0.00786	0.2	0.00192	0	1.19
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	11300	321	11000	290	0.00535	8.94	73.9	0.00786	0.2	0.00192	0	1.19
280 LANZADO ECOPACT	11400	323	11200	294	0.00536	13	75.4	0.00803	0.2	0.00192	0	1.19

280 LANZADO CON TEMPERATURA ECOPACT	11400	321	11100	294	0.00537	11.7	74.7	0.00795	0.2	0.00192	0	1.19
300 BOMBA ECOPACT	12000	345	11800	310	0.00575	7.13	77.9	0.00834	0.2	0.00192	0	1.19
300 BOMBA CON RETARDANTE ECOPACT	12100	341	11700	310	0.00581	7.13	77.9	0.00834	0.2	0.00192	0	1.19
300 BOMBA CON TEMPERATURA ECOPACT	12100	342	11800	310	0.00562	7.13	77.9	0.00834	0.2	0.00192	0	1.19
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12100	342	11700	310	0.00561	7.13	77.9	0.00834	0.2	0.00192	0	1.19

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	125	0.211	676	7.14e-05	1.63	0.00445	10500
Maximum	132	0.224	721	7.59e-05	1.72	0.00474	11200
Mean	129	0.218	702	7.4e-05	1.68	0.00462	10900
Median	130	0.22	708	7.46e-05	1.7	0.00466	11000
350 BOMBA ECOPACT	130	0.22	708	7.46e-05	1.7	0.00466	11000
350 BOMBA CON RETARDANTE ECOPACT	130	0.22	708	7.46e-05	1.7	0.00466	11000
350 BOMBA CON TEMPERATURA ECOPACT	130	0.22	708	7.46e-05	1.7	0.00466	11000
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	130	0.22	708	7.46e-05	1.7	0.00466	11000
350 SEMIFLUIDO ECOPACT	125	0.211	676	7.14e-05	1.63	0.00445	10500

350 SEMIFLUIDO CON RETARDANTE ECOPACT	125	0.211	676	7.14e-05	1.63	0.00445	10500
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	125	0.211	676	7.14e-05	1.63	0.00445	10500
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	125	0.211	676	7.14e-05	1.63	0.00445	10500
350 FLUIDO ECOPACT	132	0.224	721	7.59e-05	1.72	0.00474	11200
350 FLUIDO CON RETARDANTE ECOPACT	132	0.224	721	7.59e-05	1.72	0.00474	11200
350 FLUIDO CON TEMPERATURA ECOPACT	132	0.224	721	7.59e-05	1.72	0.00474	11200
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	132	0.224	721	7.59e-05	1.72	0.00474	11200

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	11700	332	11400	301	0.0055	7.66	76.2	0.00814	0.2	0.00192	0	1.19
Maximum	12500	355	12200	323	0.00597	7.83	80.2	0.00862	0.205	0.00192	0	1.19
Mean	12200	345	11800	313	0.00576	7.73	78.5	0.00842	0.203	0.00192	0	1.19
Median	12300	350	12000	316	0.00579	7.76	79.1	0.00849	0.205	0.00192	0	1.19
350 BOMBA ECOPACT	12300	352	11900	316	0.00578	7.66	79.1	0.00849	0.2	0.00192	0	1.19
350 BOMBA CON RETARDANTE ECOPACT	12300	349	11900	314	0.00575	7.66	79.1	0.00849	0.2	0.00192	0	1.19
350 BOMBA CON TEMPERATURA ECOPACT	12300	350	12000	317	0.00582	7.66	79.1	0.00849	0.2	0.00192	0	1.19
350 BOMBA CON RETARDANTE Y	12300	350	12000	316	0.00583	7.66	79.1	0.00849	0.2	0.00192	0	1.19

TEMPERATURA ECOPACT												
350 SEMIFLUIDO ECOPACT	11700	333	11400	302	0.0055	7.83	76.3	0.00814	0.205	0.00192	0	1.19
350 SEMIFLUIDO CON RETARDANTE ECOPACT	11800	332	11500	301	0.00561	7.79	76.2	0.00814	0.205	0.00192	0	1.19
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	11800	332	11400	301	0.00566	7.79	76.2	0.00814	0.205	0.00192	0	1.19
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11800	333	11400	301	0.00553	7.71	76.2	0.00814	0.205	0.00192	0	1.19
350 FLUIDO ECOPACT	12500	352	12200	321	0.0058	7.76	80.2	0.00862	0.205	0.00192	0	1.19
350 FLUIDO CON RETARDANTE ECOPACT	12500	353	12100	322	0.00592	7.76	80.2	0.00862	0.205	0.00192	0	1.19
350 FLUIDO CON TEMPERATURA ECOPACT	12500	355	12100	321	0.00597	7.76	80.2	0.00862	0.205	0.00192	0	1.19
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12500	354	12200	323	0.00591	7.76	80.2	0.00862	0.205	0.00192	0	1.19

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	124	0.209	670	7.08e-05	1.62	0.00441	10400
Maximum	127	0.215	689	7.27e-05	1.66	0.00453	10700
Mean	126	0.213	683	7.21e-05	1.65	0.00449	10600
Median	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 BOMBA ECOPACT	124	0.209	670	7.08e-05	1.62	0.00441	10400
420 BOMBA CON RETARDANTE ECOPACT	124	0.209	670	7.08e-05	1.62	0.00441	10400
420 BOMBA CON TEMPERATURA ECOPACT	124	0.209	670	7.08e-05	1.62	0.00441	10400
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	124	0.209	670	7.08e-05	1.62	0.00441	10400
420 SEMIFLUIDO ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 SEMIFLUIDO CON RETARDANTE ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 FLUIDO ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 FLUIDO CON RETARDANTE ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 FLUIDO CON TEMPERATURA ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	127	0.215	689	7.27e-05	1.66	0.00453	10700

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	11600	326	11300	298	0.00543	7.84	75.8	0.00809	0.2	0.00192	0	1.19
Maximum	12000	341	11600	308	0.00575	7.91	77.4	0.00828	0.2	0.00192	0	1.19
Mean	11900	335	11500	304	0.00558	7.86	76.9	0.00822	0.2	0.00192	0	1.19
Median	12000	336	11600	307	0.00554	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 BOMBA ECOPACT	11700	328	11300	300	0.00543	7.91	75.8	0.00809	0.2	0.00192	0	1.19
420 BOMBA CON RETARDANTE ECOPACT	11600	331	11300	298	0.00553	7.91	75.8	0.00809	0.2	0.00192	0	1.19
420 BOMBA CON TEMPERATURA ECOPACT	11600	326	11300	299	0.00548	7.91	75.8	0.00809	0.2	0.00192	0	1.19
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	11700	327	11400	298	0.0055	7.91	75.8	0.00809	0.2	0.00192	0	1.19
420 SEMIFLUIDO ECOPACT	11900	336	11600	307	0.00553	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 SEMIFLUIDO CON RETARDANTE ECOPACT	12000	340	11600	308	0.00553	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	12000	341	11600	308	0.00575	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12000	337	11600	307	0.00568	7.84	77.4	0.00828	0.2	0.00192	0	1.19

420 FLUIDO ECOPACT	12000	338	11600	306	0.00567	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 FLUIDO CON RETARDANTE ECOPACT	12000	339	11600	307	0.00554	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 FLUIDO CON TEMPERATURA ECOPACT	12000	339	11600	308	0.00567	7.84	77.4	0.00828	0.2	0.00192	0	1.19
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11900	336	11600	307	0.00559	7.84	77.4	0.00828	0.2	0.00192	0	1.19

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.