ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT SONSONATE** facility in Sonsonate, 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:	10 January 2023
Period of Validity:	5 years; valid until 10 January 2028
EPD Number:	c95fd041-c0be-4bd6-b817-8c6ed291ae0a

TABLE OF CONTENTS

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 concrete facility in Acajutla, 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
Fiber	polypropylene, granulate	1	0	0	0.05
Water	tap water	1	0	0	0.05
Gravel	gravel, crushed	1	0	0	0.05
River sand 1	sand	1	0	0	0.05
River sand 2	sand	1	0	0	0.05
Additives	chemical, organic	1	0	0	0.05

SYSTEM BOUNDARIES

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

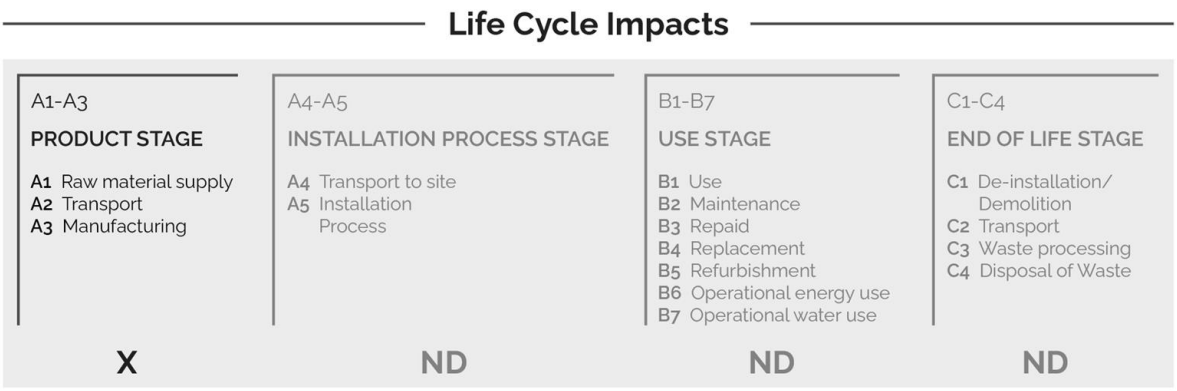

Figure 1: **General life cycle phases for consideration in a construction works system.**

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.

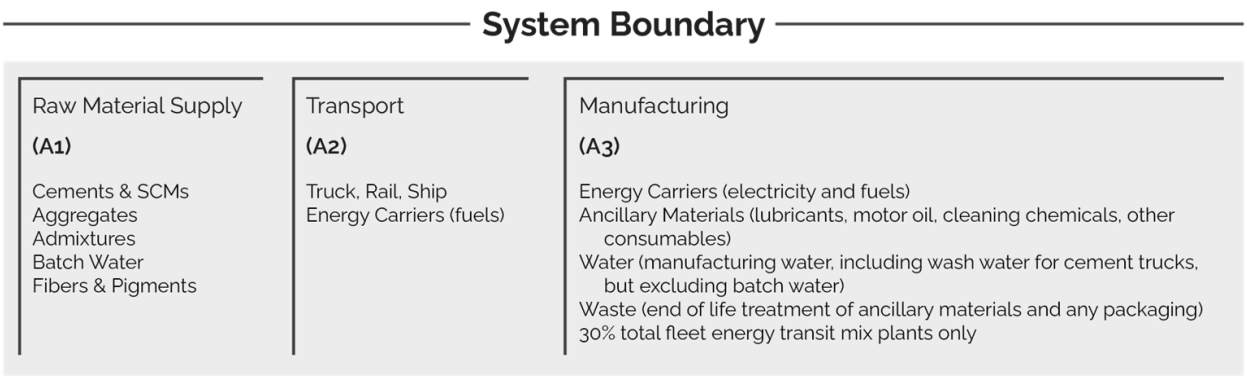

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

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 Sonsonate facility in El Salvador. All operating data is formulated using the actual data from Holcim El Salvador's plant at the above location, including water, energy consumption and waste generation. All inputs for this system boundary are calculated for the plant.

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

CUT-OFF CRITERIA

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

DATA SOURCES AND DATA QUALITY ASSESSMENT

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

Electricity: Electricity consumption values are for Holcim El Salvador in calendar year 2021. These values were direct reported from Holcim records. The unit process "market for electricity, medium voltage/electricity, medium voltage/EC/kWh" was used to represent the El Salvador grid electricity used by the concrete plant.

Process/space heating: Not applicable.

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

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

Recovered energy: Not applicable.

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

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

Direct A3 emissions accounting: Not applicable.

Waste transport requirements: Transportation distances are using estimated values. The waste hauler cannot guarantee the exact distances traveled due to the variation of route and actual location of disposal. Most waste disposal sites are near the plant therefore the 25 km distance is a representative estimate. Returned concrete and wash water, measured in kilograms, is based on direct Holcim reporting for the reference year 2021.

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

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

Table 9: **LCI inputs assumed for module A1 (i.e. raw material supply)** ***Data Quality Assessment Key Fair=1, Good=2, Very Good =3.***

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Water	tap water production, conventional with biological treatment/tap water/RoW/kg	ecoinvent v3.8	Sonsonate	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	Santa Ana	21 July 2023	3	3	3	3	3

		- EPD ID: ae8c3b6d-1972-4402-b184-115794c37a67							
River sand 1	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
Fiber	market for polypropylene, granulate/polypropylene, granulate/GLO/kg	Progam Operator: Labeling Sustainability - EPD ID: e717da92-6eee-4fdb-b7d3-acfac1d3df01	San Salvador	29 Novembe r 2022	3	3	3	3	3

DATA QUALITY ASSESSMENT

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

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

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

Consistency: To ensure consistency, the same modeling structure across the respective product systems was utilized for all inputs, which consisted of raw material inputs and ancillary material, energy flows, water resource inputs, product, and co-products outputs, returned and recovered 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	71.9	0.129	381	4.46e-05	0.958	0.00245	5890
Maximum	81.3	0.144	428	4.94e-05	1.08	0.00279	6690
Mean	76.4	0.136	403	4.69e-05	1.02	0.00261	6270
Median	75.6	0.135	397	4.66e-05	1.01	0.00256	6140
100 BOMBA ECOPACT	71.9	0.129	381	4.46e-05	0.958	0.00245	5890
100 BOMBA CON TEMPERATURA ECOPACT	71.9	0.129	381	4.46e-05	0.958	0.00245	5890
100 BOMBA CON RETARDANTE ECOPACT	72	0.129	381	4.47e-05	0.96	0.00245	5910
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	72	0.129	381	4.47e-05	0.96	0.00245	5910
100 BOMBA CON FIBRA ECOPACT	74.1	0.133	394	4.59e-05	0.986	0.00253	6090

100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	74.2	0.133	394	4.6e-05	0.988	0.00254	6110
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	74.1	0.133	394	4.59e-05	0.986	0.00253	6090
100 DIRECTO ECOPACT	72.9	0.131	382	4.49e-05	0.975	0.00246	5910
100 DIRECTO CON TEMPERATURA ECOPACT	72.9	0.131	382	4.49e-05	0.975	0.00246	5910
100 DIRECTO CON RETARDANTE ECOPACT	75.6	0.135	397	4.66e-05	1.01	0.00256	6150
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	75.6	0.135	397	4.66e-05	1.01	0.00256	6150
100 DIRECTO CON FIBRA ECOPACT	75.5	0.135	397	4.65e-05	1.01	0.00255	6130
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	75.7	0.135	398	4.66e-05	1.01	0.00256	6150
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	75.5	0.135	397	4.65e-05	1.01	0.00255	6130
140 DIRECTO ECOPACT	80.6	0.143	426	4.9e-05	1.07	0.00278	6660
140 DIRECTO CON RETARDANTE ECOPACT	80.6	0.143	427	4.9e-05	1.07	0.00278	6670
140 DIRECTO CON TEMPERATURA ECOPACT	80.6	0.143	426	4.9e-05	1.07	0.00278	6660
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	80.6	0.143	427	4.9e-05	1.07	0.00278	6670
140 BOMBA ECOPACT	81.2	0.144	428	4.93e-05	1.08	0.00279	6690
140 BOMBA CON RETARDANTE ECOPACT	81.3	0.144	428	4.94e-05	1.08	0.00279	6690
140 BOMBA CON TEMPERATURA ECOPACT	81.2	0.144	428	4.93e-05	1.08	0.00279	6690
140 BOMBA CON RETARDANTE Y	81.3	0.144	428	4.94e-05	1.08	0.00279	6690

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	6520	180	6370	168	0.00309	10.6	66.8	0.00582	0.178	6.4e-05	0	4.24
Maximum	7460	206	7250	191	0.00361	12.1	70.9	0.00631	0.189	6.4e-05	0	4.24
Mean	6970	192	6780	179	0.00333	11.5	69.1	0.00607	0.185	6.4e-05	0	4.24
Median	6840	188	6650	175	0.00327	11.9	69.8	0.00609	0.184	6.4e-05	0	4.24
100 BOMBA ECOPACT	6570	180	6370	168	0.00313	12	66.8	0.00582	0.184	6.4e-05	0	4.24
100 BOMBA CON TEMPERATURA ECOPACT	6520	180	6370	168	0.00317	12	66.8	0.00582	0.184	6.4e-05	0	4.24
100 BOMBA CON RETARDANTE ECOPACT	6560	181	6390	169	0.0031	12	66.9	0.00583	0.184	6.4e-05	0	4.24
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	6590	180	6390	168	0.00309	12	66.9	0.00583	0.184	6.4e-05	0	4.24
100 BOMBA CON FIBRA ECOPACT	6780	188	6590	173	0.00328	12.1	68.1	0.00596	0.189	6.4e-05	0	4.24
100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	6800	186	6620	174	0.00324	12.1	68.1	0.00597	0.189	6.4e-05	0	4.24
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	6770	185	6590	175	0.00321	12.1	68.1	0.00596	0.189	6.4e-05	0	4.24
100 DIRECTO ECOPACT	6590	181	6400	169	0.00315	11.4	67.6	0.00588	0.178	6.4e-05	0	4.24
100 DIRECTO CON	6590	181	6390	168	0.00318	11.4	67.6	0.00588	0.178	6.4e-05	0	4.24

TEMPERATURA ECOPACT												
100 DIRECTO CON RETARDANTE ECOPACT	6840	188	6680	175	0.00328	11.9	69.8	0.00609	0.178	6.4e-05	0	4.24
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	6840	191	6650	176	0.00328	11.9	69.8	0.00609	0.178	6.4e-05	0	4.24
100 DIRECTO CON FIBRA ECOPACT	6820	188	6640	175	0.00326	11.9	69.8	0.00609	0.189	6.4e-05	0	4.24
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	6850	189	6650	175	0.00326	11.9	69.9	0.00609	0.184	6.4e-05	0	4.24
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	6840	188	6660	175	0.00325	11.9	69.8	0.00609	0.189	6.4e-05	0	4.24
140 DIRECTO ECOPACT	7410	205	7190	190	0.00352	10.6	70	0.00623	0.184	6.4e-05	0	4.24
140 DIRECTO CON RETARDANTE ECOPACT	7420	206	7210	191	0.00355	10.6	70	0.00624	0.184	6.4e-05	0	4.24
140 DIRECTO CON TEMPERATURA ECOPACT	7420	204	7220	190	0.00352	10.6	70	0.00623	0.184	6.4e-05	0	4.24
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7430	205	7240	190	0.00359	10.6	70	0.00624	0.184	6.4e-05	0	4.24
140 BOMBA ECOPACT	7460	205	7250	191	0.00351	10.9	70.9	0.00631	0.189	6.4e-05	0	4.24
140 BOMBA CON RETARDANTE ECOPACT	7450	206	7250	191	0.00359	10.9	70.9	0.00631	0.189	6.4e-05	0	4.24
140 BOMBA CON TEMPERATURA ECOPACT	7440	205	7240	191	0.00356	10.9	70.9	0.00631	0.189	6.4e-05	0	4.24
140 BOMBA CON	7450	206	7250	191	0.00361	10.9	70.9	0.00631	0.189	6.4e-05	0	4.24

RETARDANTE Y 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	84.2	0.149	446	5.08e-05	1.11	0.00291	6980
Maximum	87.4	0.154	460	5.24e-05	1.16	0.00301	7210
Mean	85.7	0.152	453	5.16e-05	1.14	0.00296	7090
Median	86.2	0.152	454	5.17e-05	1.14	0.00297	7110
180 BOMBA ECOPACT	84.3	0.149	446	5.09e-05	1.12	0.00291	6980
180 BOMBA CON TEMPERATURA ECOPACT	84.3	0.149	446	5.09e-05	1.12	0.00291	6980
180 BOMBA CON RETARDANTE ECOPACT	84.3	0.149	446	5.09e-05	1.12	0.00292	7000
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	84.2	0.149	446	5.08e-05	1.11	0.00291	6990
180 BOMBA CON FIBRA ECOPACT	86.2	0.153	458	5.2e-05	1.14	0.00299	7170
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	86.4	0.153	459	5.21e-05	1.14	0.003	7190
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	86.2	0.153	458	5.2e-05	1.14	0.00299	7170
180 DIRECTO ECOPACT	85.1	0.15	447	5.11e-05	1.13	0.00292	7000
180 DIRECTO CON TEMPERATURA ECOPACT	85.1	0.15	447	5.11e-05	1.13	0.00292	7000
180 DIRECTO CON RETARDANTE ECOPACT	86.2	0.152	454	5.17e-05	1.14	0.00297	7110

180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	86.2	0.152	454	5.17e-05	1.14	0.00297	7110
180 DIRECTO CON FIBRA ECOPACT	87.2	0.154	459	5.23e-05	1.15	0.003	7190
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	87.4	0.154	460	5.24e-05	1.16	0.00301	7210
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	87.2	0.154	459	5.23e-05	1.15	0.003	7190

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	7770	215	7540	199	0.00367	10.3	70.8	0.00639	0.178	6.4e-05	0	4.24
Maximum	8070	224	7810	206	0.00385	11	72.9	0.00659	0.189	6.4e-05	0	4.24
Mean	7890	219	7680	202	0.00377	10.6	72	0.0065	0.184	6.4e-05	0	4.24
Median	7920	218	7680	203	0.00377	10.6	72	0.00652	0.184	6.4e-05	0	4.24
180 BOMBA ECOPACT	7770	215	7550	199	0.00367	11	71.3	0.00643	0.184	6.4e-05	0	4.24
180 BOMBA CON TEMPERATURA ECOPACT	7770	215	7540	199	0.00372	11	71.3	0.00643	0.184	6.4e-05	0	4.24
180 BOMBA CON RETARDANTE ECOPACT	7790	215	7600	200	0.00371	10.8	71.1	0.00641	0.184	6.4e-05	0	4.24
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7800	215	7560	199	0.00368	10.7	70.8	0.00639	0.184	6.4e-05	0	4.24
180 BOMBA CON FIBRA ECOPACT	7970	221	7720	205	0.00384	10.7	72	0.00652	0.189	6.4e-05	0	4.24
180 BOMBA CON FIBRA Y	7990	222	7780	204	0.00376	10.7	72	0.00653	0.189	6.4e-05	0	4.24

RETARDANTE ECOPACT												
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	7970	218	7760	205	0.00381	10.7	72	0.00652	0.189	6.4e-05	0	4.24
180 DIRECTO ECOPACT	7780	216	7580	199	0.00376	10.4	71.9	0.00646	0.178	6.4e-05	0	4.24
180 DIRECTO CON TEMPERATURA ECOPACT	7770	216	7600	200	0.0037	10.4	71.9	0.00646	0.178	6.4e-05	0	4.24
180 DIRECTO CON RETARDANTE ECOPACT	7910	221	7700	203	0.00385	10.3	72.3	0.00652	0.178	6.4e-05	0	4.24
180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7930	219	7670	203	0.00382	10.3	72.3	0.00652	0.178	6.4e-05	0	4.24
180 DIRECTO CON FIBRA ECOPACT	7990	222	7800	205	0.00384	10.3	72.9	0.00658	0.189	6.4e-05	0	4.24
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	8070	224	7810	206	0.00378	10.3	72.9	0.00659	0.189	6.4e-05	0	4.24
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	8000	222	7800	205	0.00383	10.3	72.9	0.00658	0.189	6.4e-05	0	4.24

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	94.7	0.167	508	5.72e-05	1.25	0.00332	7940
Maximum	130	0.223	679	7.37e-05	1.7	0.00448	10600
Mean	102	0.18	551	6.15e-05	1.34	0.00361	8630
Median	101	0.178	541	6.05e-05	1.32	0.00356	8500

210 DIRECTO ECOPACT	98.1	0.172	520	5.84e-05	1.29	0.0034	8100
210 DIRECTO CON TEMPERATURA ECOPACT	98.1	0.172	520	5.84e-05	1.29	0.0034	8100
210 DIRECTO CON RETARDANTE ECOPACT	98.2	0.172	520	5.84e-05	1.3	0.0034	8120
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	98.2	0.172	520	5.84e-05	1.3	0.0034	8120
210 DIRECTO CON FIBRA ECOPACT	100	0.176	532	5.96e-05	1.32	0.00348	8300
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	100	0.176	533	5.96e-05	1.32	0.00349	8310
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	100	0.176	532	5.96e-05	1.32	0.00348	8300
210 BOMBA ECOPACT	95.7	0.169	510	5.75e-05	1.26	0.00334	7980
210 BOMBA CON TEMPERATURA ECOPACT	95.7	0.169	510	5.75e-05	1.26	0.00334	7980
210 BOMBA CON RETARDANTE ECOPACT	95.1	0.168	509	5.72e-05	1.25	0.00334	7990
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	95.1	0.168	509	5.72e-05	1.25	0.00334	7990
210 BOMBA CON FIBRA ECOPACT	97.9	0.172	523	5.88e-05	1.29	0.00342	8180
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	97.3	0.171	522	5.85e-05	1.28	0.00342	8190
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	97.9	0.172	523	5.88e-05	1.29	0.00342	8180
210 BOMBA PP ECOPACT	94.7	0.167	508	5.72e-05	1.25	0.00332	7940
210 BOMBA PP CON TEMPERATURA ECOPACT	94.7	0.167	508	5.72e-05	1.25	0.00332	7940
210 SEMIFLUIDO ECOPACT	100	0.177	539	6.02e-05	1.32	0.00354	8460

210 SEMIFLUIDO CON TEMPERATURA ECOPACT	100	0.177	539	6.02e-05	1.32	0.00354	8460
210 SEMIFLUIDO CON RETARDANTE ECOPACT	101	0.177	540	6.03e-05	1.32	0.00355	8490
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	101	0.177	540	6.03e-05	1.32	0.00355	8490
210 SEMIFLUIDO CON FIBRA ECOPACT	101	0.177	540	6.04e-05	1.32	0.00355	8470
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	101	0.178	541	6.05e-05	1.33	0.00356	8500
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	101	0.177	540	6.04e-05	1.32	0.00355	8470
210 SEMIFLUIDO 3/8 ECOPACT	105	0.187	583	6.48e-05	1.37	0.00382	9150
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	107	0.189	590	6.55e-05	1.39	0.00387	9270
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	105	0.187	583	6.48e-05	1.37	0.00382	9150
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	107	0.189	590	6.55e-05	1.39	0.00387	9270
210 FLUIDO ECOPACT	101	0.178	548	6.12e-05	1.32	0.00359	8600
210 FLUIDO CON TEMPERATURA ECOPACT	101	0.178	548	6.12e-05	1.32	0.00359	8600
210 FLUIDO CON RETARDANTE ECOPACT	101	0.178	548	6.13e-05	1.32	0.0036	8620
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	101	0.178	548	6.13e-05	1.32	0.0036	8620
210 FLUIDO CON FIBRA ECOPACT	102	0.18	554	6.19e-05	1.33	0.00363	8700
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	102	0.18	555	6.19e-05	1.33	0.00364	8720

210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	102	0.18	555	6.19e-05	1.33	0.00364	8720
210 FLUIDO 3/8 ECOPACT	109	0.192	602	6.66e-05	1.41	0.00394	9440
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	109	0.192	602	6.67e-05	1.41	0.00395	9460
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	109	0.192	602	6.66e-05	1.41	0.00394	9440
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	109	0.192	602	6.67e-05	1.41	0.00395	9460
210 LANZADO ECOPACT	109	0.193	607	6.75e-05	1.41	0.00396	9480
210 LANZADO CON TEMPERATURA ECOPACT	109	0.193	607	6.75e-05	1.41	0.00396	9480
210 PERMEABLE ECOPACT	130	0.223	679	7.37e-05	1.7	0.00448	10600
245 DIRECTO ECOPACT	103	0.18	546	6.09e-05	1.36	0.00358	8530
245 BOMBA ECOPACT	103	0.181	552	6.15e-05	1.35	0.00362	8640
250 DIRECTO ECOPACT	103	0.18	546	6.09e-05	1.36	0.00358	8530
250 BOMBA ECOPACT	103	0.181	552	6.15e-05	1.35	0.00362	8640

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	8830	246	8580	226	0.00418	1	76.5	0.00706	0.105	6.4e-05	0	4.24
Maximum	11800	346	11500	303	0.00573	12.7	91.5	0.00875	0.205	6.4e-05	0	4.24
Mean	9610	267	9340	246	0.00459	10.2	80.7	0.00752	0.189	6.4e-05	0	4.24
Median	9470	263	9220	243	0.00452	9.94	79.6	0.00741	0.189	6.4e-05	0	4.24
210 DIRECTO ECOPACT	9040	255	8750	231	0.00436	9.16	78.5	0.00722	0.178	6.4e-05	0	4.24
210 DIRECTO CON	9040	254	8780	232	0.00429	9.16	78.5	0.00722	0.178	6.4e-05	0	4.24

TEMPERATURA ECOPACT												
210 DIRECTO CON RETARDANTE ECOPACT	9040	253	8790	232	0.00441	9.17	78.5	0.00723	0.178	6.4e-05	0	4.24
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	9080	255	8770	232	0.0044	9.17	78.5	0.00723	0.178	6.4e-05	0	4.24
210 DIRECTO CON FIBRA ECOPACT	9260	260	8960	237	0.00444	8.98	79.4	0.00734	0.189	6.4e-05	0	4.24
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	9300	263	9010	238	0.00451	8.98	79.4	0.00734	0.189	6.4e-05	0	4.24
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	9280	260	8960	237	0.00446	8.98	79.4	0.00734	0.189	6.4e-05	0	4.24
210 BOMBA ECOPACT	8880	247	8660	227	0.00426	9.84	78	0.00714	0.184	6.4e-05	0	4.24
210 BOMBA CON TEMPERATURA ECOPACT	8880	247	8630	228	0.00422	9.84	78	0.00714	0.184	6.4e-05	0	4.24
210 BOMBA CON RETARDANTE ECOPACT	8900	249	8670	228	0.00424	10.4	76.5	0.00706	0.189	6.4e-05	0	4.24
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	8920	246	8660	228	0.00425	10.4	76.5	0.00706	0.189	6.4e-05	0	4.24
210 BOMBA CON FIBRA ECOPACT	9140	256	8830	234	0.00438	9.87	79.2	0.00728	0.189	6.4e-05	0	4.24
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	9120	256	8870	234	0.00434	10.5	77.8	0.0072	0.189	6.4e-05	0	4.24
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	9100	253	8840	233	0.00446	9.87	79.2	0.00728	0.189	6.4e-05	0	4.24

210 BOMBA PP ECOPACT	8830	247	8600	227	0.00422	10.3	77.4	0.0071	0.184	6.4e-05	0	4.24
210 BOMBA PP CON TEMPERATURA ECOPACT	8850	247	8580	226	0.00418	10.3	77.4	0.0071	0.184	6.4e-05	0	4.24
210 SEMIFLUIDO ECOPACT	9440	261	9160	242	0.00451	9.93	79.1	0.00736	0.189	6.4e-05	0	4.24
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	9410	264	9180	242	0.00451	9.93	79.1	0.00736	0.189	6.4e-05	0	4.24
210 SEMIFLUIDO CON RETARDANTE ECOPACT	9450	262	9200	243	0.00451	9.93	79.2	0.00737	0.189	6.4e-05	0	4.24
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9460	262	9220	242	0.0045	9.93	79.2	0.00737	0.189	6.4e-05	0	4.24
210 SEMIFLUIDO CON FIBRA ECOPACT	9460	263	9180	242	0.0045	9.94	79.6	0.0074	0.2	6.4e-05	0	4.24
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	9470	263	9220	243	0.00452	9.94	79.6	0.00741	0.2	6.4e-05	0	4.24
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9440	261	9180	242	0.00457	9.94	79.6	0.0074	0.2	6.4e-05	0	4.24
210 SEMIFLUIDO 3/8 ECOPACT	10200	280	9890	262	0.00473	11.7	83.3	0.00784	0.2	6.4e-05	0	4.24
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	10300	284	10000	265	0.00486	11.7	84	0.00792	0.2	6.4e-05	0	4.24
210 SEMIFLUIDO	10200	278	9930	261	0.00479	11.7	83.3	0.00784	0.2	6.4e-05	0	4.24

3/8 CON TEMPERATURA ECOPACT												
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10330	285	10000	266	0.00489	11.7	84	0.00792	0.2	6.4e-05	0	4.24
210 FLUIDO ECOPACT	9550	262	9310	246	0.00452	11.4	80.3	0.00749	0.194	6.4e-05	0	4.24
210 FLUIDO CON TEMPERATURA ECOPACT	9580	263	9330	246	0.00454	11.4	80.3	0.00749	0.194	6.4e-05	0	4.24
210 FLUIDO CON RETARDANTE ECOPACT	9600	265	9360	246	0.00457	11.4	80.4	0.0075	0.194	6.4e-05	0	4.24
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9620	266	9340	246	0.00457	11.4	80.4	0.0075	0.194	6.4e-05	0	4.24
210 FLUIDO CON FIBRA ECOPACT	9670	270	9440	248	0.00463	11.5	80.9	0.00756	0.194	6.4e-05	0	4.24
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	9740	267	9410	249	0.00463	11.4	80.9	0.00756	0.194	6.4e-05	0	4.24
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9720	267	9480	248	0.0046	11.4	80.9	0.00756	0.194	6.4e-05	0	4.24
210 FLUIDO 3/8 ECOPACT	10500	289	10200	269	0.00499	11.7	84.9	0.00803	0.205	6.4e-05	0	4.24
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	10500	290	10300	271	0.00502	11.7	85	0.00804	0.205	6.4e-05	0	4.24
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	10500	289	10200	270	0.00503	11.7	84.9	0.00803	0.205	6.4e-05	0	4.24
210 FLUIDO 3/8 CON RETARDANT	10500	290	10200	269	0.00507	11.7	85	0.00804	0.205	6.4e-05	0	4.24

E Y TEMPERATURA ECOPACT												
210 LANZADO ECOPACT	10600	293	10200	271	0.00493	12.7	86.7	0.00817	0.184	6.4e-05	0	4.24
210 LANZADO CON TEMPERATURA ECOPACT	10600	293	10300	271	0.00492	12.7	86.7	0.00817	0.184	6.4e-05	0	4.24
210 PERMEABLE ECOPACT	11800	346	11500	303	0.00573	1	91.5	0.00875	0.105	6.4e-05	0	4.24
245 DIRECTO ECOPACT	9510	267	9230	244	0.0045	8.39	80.5	0.00747	0.184	6.4e-05	0	4.24
245 BOMBA ECOPACT	9590	269	9340	247	0.0046	9.34	80.8	0.00752	0.189	6.4e-05	0	4.24
250 DIRECTO ECOPACT	9520	268	9280	244	0.00467	8.39	80.5	0.00747	0.184	6.4e-05	0	4.24
250 BOMBA ECOPACT	9630	271	9330	247	0.00456	9.34	80.8	0.00752	0.189	6.4e-05	0	4.24

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	111	0.194	592	6.6e-05	1.46	0.00389	9250
Maximum	135	0.234	731	7.96e-05	1.75	0.00482	11500
Mean	118	0.207	642	7.07e-05	1.54	0.00422	10100
Median	116	0.202	628	6.91e-05	1.52	0.00412	9860
280 DIRECTO ECOPACT	111	0.194	592	6.6e-05	1.46	0.00389	9250
280 DIRECTO CON TEMPERATURA ECOPACT	111	0.194	593	6.6e-05	1.46	0.00389	9250
280 DIRECTO CON RETARDANTE ECOPACT	111	0.194	593	6.6e-05	1.46	0.00389	9250
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.194	593	6.6e-05	1.46	0.00389	9250

280 DIRECTO CON FIBRA ECOPACT	112	0.196	599	6.66e-05	1.47	0.00393	9350
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	112	0.196	599	6.66e-05	1.47	0.00393	9350
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	112	0.196	599	6.66e-05	1.47	0.00393	9350
280 BOMBA ECOPACT	115	0.2	617	6.81e-05	1.5	0.00406	9680
280 BOMBA CON TEMPERATURA ECOPACT	115	0.2	617	6.81e-05	1.5	0.00406	9680
280 BOMBA CON RETARDANTE ECOPACT	115	0.201	618	6.82e-05	1.5	0.00407	9690
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	115	0.201	618	6.82e-05	1.5	0.00407	9690
280 BOMBA CON FIBRA ECOPACT	116	0.202	624	6.88e-05	1.52	0.0041	9780
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	116	0.203	624	6.89e-05	1.52	0.00411	9790
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	116	0.202	624	6.88e-05	1.52	0.0041	9780
280 BOMBA PP ECOPACT	114	0.199	616	6.8e-05	1.49	0.00405	9660
280 BOMBA PP CON TEMPERATURA ECOPACT	114	0.199	616	6.8e-05	1.49	0.00405	9660
280 SEMIFLUIDO ECOPACT	114	0.2	621	6.84e-05	1.49	0.00408	9750
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	114	0.2	621	6.84e-05	1.49	0.00408	9750
280 SEMIFLUIDO CON RETARDANTE ECOPACT	114	0.2	621	6.85e-05	1.49	0.00408	9760
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	114	0.2	621	6.85e-05	1.49	0.00408	9760
280 SEMIFLUIDO CON FIBRA ECOPACT	115	0.202	628	6.91e-05	1.5	0.00412	9850

280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	115	0.202	628	6.91e-05	1.5	0.00413	9860
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	115	0.202	628	6.91e-05	1.5	0.00412	9850
280 SEMIFLUIDO 3/8 ECOPACT	121	0.211	659	7.23e-05	1.57	0.00434	10300
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	122	0.213	666	7.3e-05	1.59	0.00439	10500
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	121	0.211	659	7.23e-05	1.57	0.00434	10300
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	122	0.213	666	7.3e-05	1.59	0.00439	10500
280 FLUIDO ECOPACT	116	0.203	634	6.98e-05	1.51	0.00417	9960
280 FLUIDO CON TEMPERATURA ECOPACT	116	0.203	634	6.98e-05	1.51	0.00417	9960
280 FLUIDO CON RETARDANTE ECOPACT	117	0.205	641	7.05e-05	1.52	0.00421	10100
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	117	0.205	641	7.05e-05	1.52	0.00421	10100
280 FLUIDO CON FIBRA ECOPACT	117	0.205	640	7.04e-05	1.52	0.00421	10100
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	117	0.205	641	7.04e-05	1.52	0.00421	10100
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	117	0.205	640	7.04e-05	1.52	0.00421	10100
280 FLUIDO 3/8 ECOPACT	125	0.218	684	7.47e-05	1.62	0.0045	10700
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	125	0.218	684	7.48e-05	1.62	0.00451	10800
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	125	0.218	684	7.47e-05	1.62	0.0045	10700
280 FLUIDO 3/8 CON RETARDANTE Y	125	0.218	684	7.48e-05	1.62	0.00451	10800

TEMPERATURA ECOPACT							
280 LANZADO ECOPACT	123	0.217	689	7.59e-05	1.6	0.00449	10700
280 LANZADO CON TEMPERATURA ECOPACT	122	0.215	684	7.49e-05	1.58	0.00447	10700
300 BOMBA ECOPACT	134	0.234	730	7.95e-05	1.75	0.00481	11400
300 BOMBA CON RETARDANTE ECOPACT	135	0.234	731	7.96e-05	1.75	0.00482	11500
300 BOMBA CON TEMPERATURA ECOPACT	134	0.234	730	7.95e-05	1.75	0.00481	11400
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	135	0.234	731	7.96e-05	1.75	0.00482	11500

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**	**CBWC**	**CWWC**	**CHW**	**CNHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	10300	290	9970	264	0.00495	7.22	86.2	0.00806	0.184	6.4e-05	0	4.24
Maximum	12800	362	12400	328	0.00615	13.1	97.4	0.00942	0.205	6.4e-05	0	4.24
Mean	11200	314	10900	288	0.00534	9.09	89.1	0.00848	0.198	6.4e-05	0	4.24
Median	11000	307	10700	282	0.00524	9.07	87.6	0.0083	0.2	6.4e-05	0	4.24
280 DIRECTO ECOPACT	10300	291	9970	265	0.00502	7.67	86.7	0.00806	0.184	6.4e-05	0	4.24
280 DIRECTO CON TEMPERATURA ECOPACT	10300	293	10000	264	0.00501	7.67	86.7	0.00806	0.184	6.4e-05	0	4.24
280 DIRECTO CON RETARDANTE ECOPACT	10300	293	10000	265	0.00497	7.67	86.7	0.00806	0.184	6.4e-05	0	4.24
280 DIRECTO CON RETARDANT	10300	290	10000	265	0.00497	7.67	86.7	0.00806	0.184	6.4e-05	0	4.24

E Y TEMPERATURA ECOPACT												
280 DIRECTO CON FIBRA ECOPACT	10400	294	10100	267	0.00505	7.69	87.3	0.00813	0.189	6.4e-05	0	4.24
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	10500	293	10100	268	0.00495	7.69	87.3	0.00813	0.189	6.4e-05	0	4.24
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	10400	295	10100	268	0.00497	7.69	87.3	0.00813	0.189	6.4e-05	0	4.24
280 BOMBA ECOPACT	10800	303	10500	277	0.00513	8.24	87.1	0.00822	0.2	6.4e-05	0	4.24
280 BOMBA CON TEMPERATURA ECOPACT	10800	302	10500	277	0.00511	8.24	87.1	0.00822	0.2	6.4e-05	0	4.24
280 BOMBA CON RETARDANTE ECOPACT	10800	300	10500	277	0.00519	8.23	87.3	0.00824	0.194	6.4e-05	0	4.24
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10800	301	10500	277	0.00517	8.23	87.3	0.00824	0.194	6.4e-05	0	4.24
280 BOMBA CON FIBRA ECOPACT	10900	304	10600	280	0.00517	8.25	87.7	0.0083	0.2	6.4e-05	0	4.24
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	10900	305	10600	280	0.00522	8.25	87.9	0.00831	0.2	6.4e-05	0	4.24
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	10900	306	10500	279	0.00531	8.25	87.7	0.0083	0.2	6.4e-05	0	4.24
280 BOMBA PP ECOPACT	10800	304	10400	276	0.00511	9.09	86.6	0.0082	0.2	6.4e-05	0	4.24
280 BOMBA PP CON TEMPERATURA ECOPACT	10800	301	10500	277	0.00514	9.09	86.6	0.0082	0.2	6.4e-05	0	4.24

280 SEMIFLUIDO ECOPACT	10900	304	10600	279	0.0051	10	86.2	0.00821	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	10900	303	10500	278	0.00516	10	86.2	0.00821	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO CON RETARDANTE ECOPACT	10900	304	10600	279	0.00512	10	86.3	0.00822	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	10900	305	10600	279	0.0052	10	86.3	0.00822	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO CON FIBRA ECOPACT	10900	308	10700	281	0.00514	10.1	86.8	0.00828	0.205	6.4e-05	0	4.24
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	11000	307	10700	282	0.00513	10.1	86.9	0.00829	0.205	6.4e-05	0	4.24
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11000	307	10700	282	0.00519	10.1	86.8	0.00828	0.205	6.4e-05	0	4.24
280 SEMIFLUIDO 3/8 ECOPACT	11600	325	11200	296	0.00548	9.09	90.1	0.00863	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	11700	325	11300	299	0.00558	9.1	90.8	0.00871	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	11500	320	11200	295	0.00536	9.09	90.1	0.00863	0.2	6.4e-05	0	4.24
280 SEMIFLUIDO 3/8 CON	11700	327	11300	299	0.00553	9.1	90.8	0.00871	0.2	6.4e-05	0	4.24

RETARDANTE Y TEMPERATURA ECOPACT												
280 FLUIDO ECOPACT	11100	307	10800	284	0.00526	10.5	87.5	0.00836	0.2	6.4e-05	0	4.24
280 FLUIDO CON TEMPERATURA ECOPACT	11100	311	10800	284	0.00527	10.5	87.5	0.00836	0.2	6.4e-05	0	4.24
280 FLUIDO CON RETARDANTE ECOPACT	11200	314	10900	287	0.00543	10.5	88.1	0.00843	0.2	6.4e-05	0	4.24
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11200	312	10900	287	0.00541	10.5	88.1	0.00843	0.2	6.4e-05	0	4.24
280 FLUIDO CON FIBRA ECOPACT	11200	310	10900	288	0.00526	10.5	87.9	0.00842	0.205	6.4e-05	0	4.24
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	11300	312	10900	288	0.00535	10.5	87.9	0.00842	0.205	6.4e-05	0	4.24
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11200	313	10900	287	0.00537	10.5	87.9	0.00842	0.205	6.4e-05	0	4.24
280 FLUIDO 3/8 ECOPACT	12000	333	11600	306	0.00559	9.05	92	0.00887	0.2	6.4e-05	0	4.24
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	12000	335	11600	308	0.00564	9.05	92	0.00888	0.2	6.4e-05	0	4.24
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	12000	336	11600	307	0.00571	9.05	92	0.00887	0.2	6.4e-05	0	4.24
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	12000	336	11600	308	0.00568	9.05	92	0.00888	0.2	6.4e-05	0	4.24
280 LANZADO ECOPACT	12000	333	11600	307	0.00555	13.1	94.6	0.00908	0.2	6.4e-05	0	4.24

280 LANZADO CON TEMPERATURA ECOPACT	11900	331	11600	306	0.00563	11.8	91.9	0.00889	0.2	6.4e-05	0	4.24
300 BOMBA ECOPACT	12800	358	12400	327	0.00604	7.22	97.3	0.00941	0.2	6.4e-05	0	4.24
300 BOMBA CON RETARDANTE ECOPACT	12800	359	12400	328	0.00601	7.22	97.4	0.00942	0.2	6.4e-05	0	4.24
300 BOMBA CON TEMPERATURA ECOPACT	12700	358	12400	328	0.00604	7.22	97.3	0.00941	0.2	6.4e-05	0	4.24
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12800	362	12400	328	0.00615	7.22	97.4	0.00942	0.2	6.4e-05	0	4.24

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	131	0.227	711	7.75e-05	1.7	0.00468	11200
Maximum	138	0.24	755	8.2e-05	1.79	0.00498	11900
Mean	135	0.235	736	8.01e-05	1.75	0.00485	11600
Median	136	0.237	742	8.08e-05	1.77	0.0049	11600
350 BOMBA ECOPACT	136	0.237	742	8.07e-05	1.77	0.00489	11600
350 BOMBA CON RETARDANTE ECOPACT	136	0.237	743	8.08e-05	1.77	0.0049	11700
350 BOMBA CON TEMPERATURA ECOPACT	136	0.237	742	8.07e-05	1.77	0.00489	11600
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	136	0.237	743	8.08e-05	1.77	0.0049	11700
350 SEMIFLUIDO ECOPACT	131	0.227	711	7.75e-05	1.7	0.00468	11200

350 SEMIFLUIDO CON RETARDANTE ECOPACT	131	0.228	711	7.75e-05	1.7	0.00469	11200
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	131	0.227	711	7.75e-05	1.7	0.00468	11200
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	131	0.227	711	7.75e-05	1.7	0.00469	11200
350 FLUIDO ECOPACT	138	0.24	755	8.19e-05	1.79	0.00498	11900
350 FLUIDO CON RETARDANTE ECOPACT	138	0.24	755	8.2e-05	1.79	0.00498	11900
350 FLUIDO CON TEMPERATURA ECOPACT	138	0.24	755	8.19e-05	1.79	0.00498	11900
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	138	0.24	755	8.2e-05	1.79	0.00498	11900

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**	**CBWC**	**CWWC**	**CHW**	**CNHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m3**	**m3**	**kg waste**	**kg waste**	**m3**	**m3**	**kg**	**kg**
Minimum	12400	349	12100	319	0.00589	7.75	94.8	0.00917	0.2	6.4e-05	0	4.24
Maximum	13200	374	12900	340	0.00633	7.93	98.8	0.00964	0.205	6.4e-05	0	4.24
Mean	12900	363	12500	330	0.00615	7.83	97.2	0.00945	0.203	6.4e-05	0	4.24
Median	13000	366	12600	333	0.0062	7.86	98	0.00952	0.205	6.4e-05	0	4.24
350 BOMBA ECOPACT	13000	368	12600	332	0.00623	7.75	97.9	0.00952	0.2	6.4e-05	0	4.24
350 BOMBA CON RETARDANTE ECOPACT	13000	365	12600	334	0.00617	7.75	98	0.00953	0.2	6.4e-05	0	4.24
350 BOMBA CON TEMPERATURA ECOPACT	12900	366	12600	333	0.00614	7.75	97.9	0.00952	0.2	6.4e-05	0	4.24
350 BOMBA CON RETARDANTE Y	12900	363	12700	333	0.00626	7.75	98	0.00953	0.2	6.4e-05	0	4.24

TEMPERATURA ECOPACT												
350 SEMIFLUIDO ECOPACT	12400	350	12100	319	0.00598	7.93	94.9	0.00918	0.205	6.4e-05	0	4.24
350 SEMIFLUIDO CON RETARDANTE ECOPACT	12400	349	12100	319	0.00589	7.89	94.9	0.00918	0.205	6.4e-05	0	4.24
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	12500	350	12100	319	0.00601	7.89	94.9	0.00918	0.205	6.4e-05	0	4.24
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12400	352	12100	319	0.00594	7.8	94.8	0.00917	0.205	6.4e-05	0	4.24
350 FLUIDO ECOPACT	13200	371	12900	338	0.00633	7.86	98.7	0.00964	0.205	6.4e-05	0	4.24
350 FLUIDO CON RETARDANTE ECOPACT	13200	372	12900	339	0.00631	7.86	98.8	0.00964	0.205	6.4e-05	0	4.24
350 FLUIDO CON TEMPERATURA ECOPACT	13200	373	12800	340	0.00631	7.86	98.7	0.00964	0.205	6.4e-05	0	4.24
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	13200	374	12800	339	0.00628	7.86	98.8	0.00964	0.205	6.4e-05	0	4.24

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	130	0.226	705	7.7e-05	1.69	0.00465	11100

Maximum	133	0.232	724	7.89e-05	1.73	0.00478	11400
Mean	132	0.23	718	7.82e-05	1.72	0.00473	11300
Median	133	0.231	724	7.88e-05	1.73	0.00477	11400
420 BOMBA ECOPACT	130	0.226	705	7.7e-05	1.69	0.00465	11100
420 BOMBA CON RETARDANTE ECOPACT	130	0.226	706	7.71e-05	1.69	0.00465	11100
420 BOMBA CON TEMPERATURA ECOPACT	130	0.226	705	7.7e-05	1.69	0.00465	11100
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	130	0.226	705	7.7e-05	1.69	0.00465	11100
420 SEMIFLUIDO ECOPACT	133	0.231	724	7.88e-05	1.73	0.00477	11400
420 SEMIFLUIDO CON RETARDANTE ECOPACT	133	0.231	724	7.89e-05	1.73	0.00478	11400
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	133	0.231	724	7.88e-05	1.73	0.00477	11400
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	133	0.231	724	7.89e-05	1.73	0.00478	11400
420 FLUIDO ECOPACT	133	0.231	724	7.88e-05	1.73	0.00477	11400
420 FLUIDO CON RETARDANTE ECOPACT	133	0.232	724	7.89e-05	1.73	0.00478	11400
420 FLUIDO CON TEMPERATURA ECOPACT	133	0.231	724	7.88e-05	1.73	0.00477	11400
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	133	0.232	724	7.89e-05	1.73	0.00478	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	12300	346	12000	317	0.00586	7.94	94.8	0.00915	0.2	6.4e-05	0	4.24
Maximum	12700	359	12400	326	0.00605	8	96.3	0.00933	0.2	6.4e-05	0	4.24

Mean	12600	354	12200	322	0.00599	7.96	95.8	0.00927	0.2	6.4e-05	0	4.24
Median	12600	356	12300	324	0.006	7.94	96.2	0.00932	0.2	6.4e-05	0	4.24
420 BOMBA ECOPACT	12300	346	12000	317	0.00592	8	94.8	0.00915	0.2	6.4e-05	0	4.24
420 BOMBA CON RETARDANTE ECOPACT	12400	350	12000	317	0.00597	8	94.9	0.00915	0.2	6.4e-05	0	4.24
420 BOMBA CON TEMPERATURA ECOPACT	12400	348	12000	317	0.00593	8	94.8	0.00915	0.2	6.4e-05	0	4.24
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12400	349	12000	317	0.00586	8	94.8	0.00915	0.2	6.4e-05	0	4.24
420 SEMIFLUIDO ECOPACT	12700	356	12300	326	0.00603	7.94	96.2	0.00932	0.2	6.4e-05	0	4.24
420 SEMIFLUIDO CON RETARDANTE ECOPACT	12700	358	12300	325	0.00605	7.94	96.2	0.00933	0.2	6.4e-05	0	4.24
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	12600	356	12300	325	0.00603	7.94	96.2	0.00932	0.2	6.4e-05	0	4.24
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12700	358	12300	325	0.00603	7.94	96.2	0.00933	0.2	6.4e-05	0	4.24
420 FLUIDO ECOPACT	12600	359	12400	324	0.00602	7.94	96.2	0.00932	0.2	6.4e-05	0	4.24
420 FLUIDO CON RETARDANTE ECOPACT	12700	357	12300	324	0.006	7.94	96.3	0.00933	0.2	6.4e-05	0	4.24
420 FLUIDO CON TEMPERATURA ECOPACT	12700	356	12300	326	0.006	7.94	96.2	0.00932	0.2	6.4e-05	0	4.24
420 FLUIDO CON	12700	359	12400	325	0.006	7.94	96.3	0.00933	0.2	6.4e-05	0	4.24

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.