ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT KM35** facility in Usulután, 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:	15 April 2023
Period of Validity:	5 years; valid until 15 April 2028
EPD Number:	ec92d2ad-43f5-4899-8803-7dffbc8795cf

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 KM 35 concrete facility in San Vicente, 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
River Sand	sand	1	0	0	0.05

SYSTEM BOUNDARIES

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

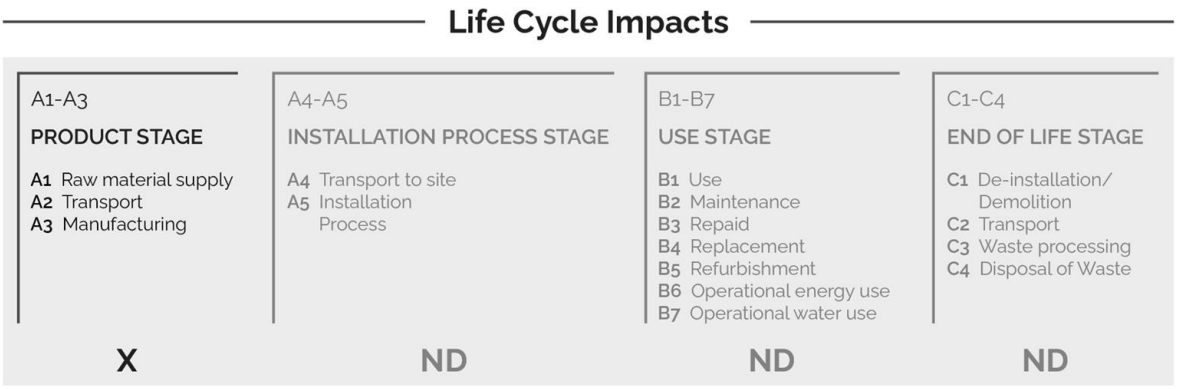

Figure 1: **General life cycle phases for consideration in a construction works system.**

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.

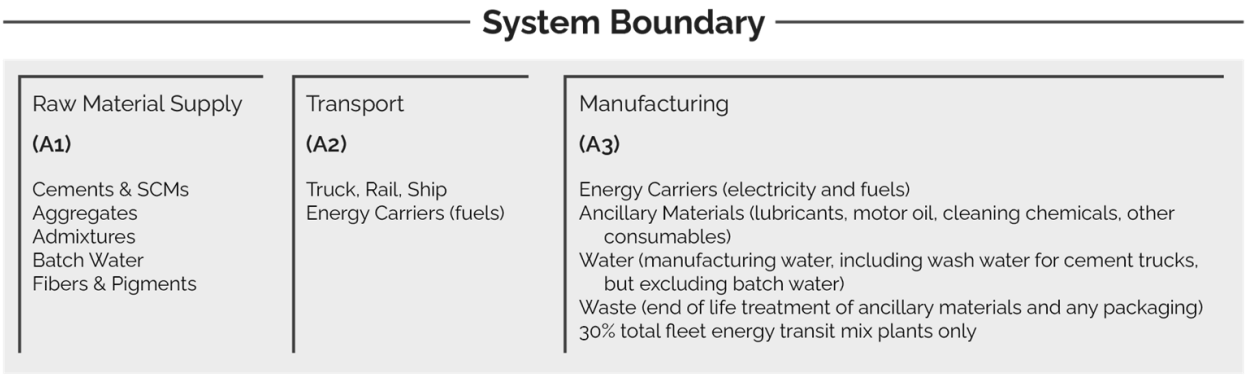

Figure 2: **General system inputs considered in the product system and categorized by modules in scope**

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 35 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	La Libertad	v3.8 in 2021	2	3	1	3	3
Acrylic Fibre	market for acrylic filler/acrylic filler/RoW/kg	ecoinvent v3.8	El Salvador	v3.8 in 2021	2	3	1	3	3
Additives	market for chemical, organic/chemical, organic/GLO/kg	ecoinvent v3.8	Sonsonate	v3.8 in 2021	2	3	1	3	3

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

DATA QUALITY ASSESSMENT

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

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

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

Consistency: To ensure consistency, the same modeling structure across the respective product systems was utilized for all inputs, which consisted of raw material inputs and ancillary material, energy flows, water resource inputs, product, and co-products outputs, returned and recovered Cement materials, emissions to air, water and soil, and waste recycling and treatment. The same background LCI datasets from the ecoinvent v3.8 database were used across all product systems. Crosschecks concerning the plausibility of mass and energy flows were continuously conducted. The LCA team conducted mass and energy balances at the plant and selected process level to maintain a high level of consistency.

Reproducibility: Internal reproducibility is possible since the data and the models are stored and available in a machine readable project file for all foreground and background processes, and in Labeling Sustainability's proprietary Ready Mix Concrete LCA calculator* for all production facility and product-specific calculations. A considerable level of transparency is provided throughout the detailed LCA report as the specifications and material quantity make-up for the declared products are presented and key primary and secondary LCI data sources are summarized. The provision of more detailed publicly accessible data to allow full external reproducibility was not possible due to reasons of confidentiality.

*Labeling Sustainability has developed a proprietary tool that allows the calculation of PCR-compliant LCA results for Ready Mix Concrete product designs. The tool auto-calculates results by scaling base-unit technosphere inputs (i.e. 1 kg sand, 1 kWh electricity, etc.) to replicate the reference flow conversions that take place in any typical LCA software like openLCA or SimaPro. The tool was tested against several LCAs performed in openLCA and the tool generated identical results to those realized in openLCA across every impact category and inventory metric (where comparisons could be readily made).

Representativeness: The representativeness of the data is summarized as follows.

- Time related coverage of the manufacturing processes primary collected data from 2021-01-01 to 2021-12-31.
- Upstream (background) LCI data was either the PCR specified default (if applicable) or more appropriate LCI datasets as found in the country-adjusted ecoinvent v3.8 database.
- Geographical coverage for inputs required by the A3 facility(ies) is representative of its region of focus; other upstream and background processes are based on US, North American, or global average data and adjusted to regional electricity mixes when relevant.
- Technological coverage is typical or average and specific to the participating facilities for all primary data.

ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

Per the PCR, this EPD supports the life cycle impact assessment indicators and inventory metrics as listed in the tables below. As specified in the PCR, the most recent US EPA Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts (TRACI), impact categories were utilized as they provide a North American context for the mandatory category indicators to be included in the EPD. Additionally, the PCR requires a set of inventory metrics to be reported with the LCIA indicators.

It should be noted that emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in any of the following categories.

LIMITATIONS

This EPD is a declaration of potential environmental impact and does not support or provide definitive comparisons of the environmental performance of specific products. Only EPDs prepared from cradle-to-grave life cycle results and based on the same function and reference service life and quantified by the same functional unit can be used to assist purchasers and users in making informed comparisons between products.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. Further, LCA offers a wide array of environmental impact indicators, and this EPD reports a collection of those, as specified by the PCR.

In addition to the impact results, this EPD provides several metrics related to resource consumption and waste generation. While these data may be informational in other ways, they do not provide a measure of impact on the environment.

TOTAL IMPACT SUMMARY

The following table reports the total LCA results for each product produced at the given ready mix concrete facility on a per 1m3 of concrete basis.

Mix designs: 0 to 15 MPa

Table 10: **Total life cycle (across modules in scope) impact results for Mix designs: 0 to 15MPa, assuming the geometric mean point values on a per 1 m3 of concrete basis.**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	**moles of H+-Eq**	**kg N**	**kg CO2-Eq**	**kg CFC-11-Eq**	**kg NOx-Eq**	**kg Sb-Eq**	**MJ, net calorific value**
Minimum	70	0.12	370	4.29e-05	0.937	0.00239	5730
Maximum	78.6	0.134	415	4.76e-05	1.05	0.00269	6440
Mean	74.2	0.127	392	4.52e-05	0.992	0.00254	6070
Median	73.4	0.125	385	4.46e-05	0.984	0.00249	5960
100 BOMBA ECOPACT	70	0.12	370	4.29e-05	0.937	0.00239	5730
100 BOMBA CON TEMPERATURA ECOPACT	70	0.12	370	4.29e-05	0.937	0.00239	5730
100 BOMBA CON RETARDANTE ECOPACT	70	0.12	370	4.29e-05	0.937	0.00239	5730
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	70	0.12	370	4.29e-05	0.937	0.00239	5730
100 BOMBA CON FIBRA ECOPACT	72.3	0.124	384	4.43e-05	0.966	0.00248	5940

100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	72.3	0.124	384	4.43e-05	0.966	0.00248	5940
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	72.3	0.124	384	4.43e-05	0.966	0.00248	5940
100 DIRECTO ECOPACT	70.9	0.121	371	4.3e-05	0.951	0.0024	5740
100 DIRECTO CON TEMPERATURA ECOPACT	70.9	0.121	371	4.3e-05	0.951	0.0024	5740
100 DIRECTO CON RETARDANTE ECOPACT	73.4	0.125	385	4.46e-05	0.984	0.00249	5960
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	73.4	0.125	385	4.46e-05	0.984	0.00249	5960
100 DIRECTO CON FIBRA ECOPACT	73.5	0.125	385	4.47e-05	0.985	0.0025	5970
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	73.5	0.125	385	4.47e-05	0.985	0.0025	5970
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	73.5	0.125	385	4.47e-05	0.985	0.0025	5970
140 DIRECTO ECOPACT	78	0.133	414	4.73e-05	1.04	0.00269	6420
140 DIRECTO CON RETARDANTE ECOPACT	78	0.133	414	4.73e-05	1.04	0.00269	6420
140 DIRECTO CON TEMPERATURA ECOPACT	78	0.133	414	4.73e-05	1.04	0.00269	6420
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	78	0.133	414	4.73e-05	1.04	0.00269	6420
140 BOMBA ECOPACT	78.6	0.134	415	4.76e-05	1.05	0.00269	6440
140 BOMBA CON RETARDANTE ECOPACT	78.6	0.134	415	4.76e-05	1.05	0.00269	6440
140 BOMBA CON TEMPERATURA ECOPACT	78.6	0.134	415	4.76e-05	1.05	0.00269	6440
140 BOMBA CON RETARDANTE Y	78.6	0.134	415	4.76e-05	1.05	0.00269	6440

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	6380	172	6200	164	0.00297	10.6	58.4	0.00554	0.178	0.000533	0	0.544
Maximum	7190	197	6990	184	0.00344	12	62.9	0.00604	0.189	0.000533	0	0.544
Mean	6760	184	6580	173	0.00318	11.5	60.7	0.00579	0.185	0.000533	0	0.544
Median	6640	180	6460	170	0.00314	11.8	60.7	0.00576	0.184	0.000533	0	0.544
100 BOMBA ECOPACT	6380	173	6200	164	0.00305	12	58.4	0.00554	0.184	0.000533	0	0.544
100 BOMBA CON TEMPERATURA ECOPACT	6390	172	6210	164	0.00297	12	58.4	0.00554	0.184	0.000533	0	0.544
100 BOMBA CON RETARDANTE ECOPACT	6380	173	6200	164	0.00303	12	58.4	0.00554	0.184	0.000533	0	0.544
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	6400	172	6220	164	0.00304	12	58.4	0.00554	0.184	0.000533	0	0.544
100 BOMBA CON FIBRA ECOPACT	6600	179	6440	170	0.00311	12	59.9	0.0057	0.189	0.000533	0	0.544
100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	6630	178	6440	170	0.00313	12	59.9	0.0057	0.189	0.000533	0	0.544
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	6600	180	6430	169	0.00307	12	59.9	0.0057	0.189	0.000533	0	0.544
100 DIRECTO ECOPACT	6410	173	6200	164	0.00301	11.4	58.7	0.00556	0.178	0.000533	0	0.544
100 DIRECTO CON TEMPERATURA ECOPACT	6380	174	6220	164	0.00297	11.4	58.7	0.00556	0.178	0.000533	0	0.544

100 DIRECTO CON RETARDANTE ECOPACT	6630	180	6500	171	0.00315	11.8	60.6	0.00576	0.178	0.00033	0	0.544
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	6650	181	6440	170	0.00313	11.8	60.6	0.00576	0.178	0.00033	0	0.544
100 DIRECTO CON FIBRA ECOPACT	6660	180	6490	171	0.00314	11.9	60.8	0.00577	0.189	0.00033	0	0.544
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	6640	179	6490	170	0.00315	11.9	60.8	0.00577	0.184	0.00033	0	0.544
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	6630	178	6440	170	0.00314	11.9	60.8	0.00577	0.189	0.00033	0	0.544
140 DIRECTO ECOPACT	7150	194	6960	183	0.00335	10.6	62.2	0.00598	0.184	0.00033	0	0.544
140 DIRECTO CON RETARDANTE ECOPACT	7150	197	6970	183	0.0033	10.6	62.2	0.00598	0.184	0.00033	0	0.544
140 DIRECTO CON TEMPERATURA ECOPACT	7150	197	6950	183	0.00337	10.6	62.2	0.00598	0.184	0.00033	0	0.544
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7150	195	6950	183	0.00344	10.6	62.2	0.00598	0.184	0.00033	0	0.544
140 BOMBA ECOPACT	7190	196	6970	184	0.00337	10.9	62.9	0.00604	0.189	0.00033	0	0.544
140 BOMBA CON RETARDANTE ECOPACT	7190	196	6970	184	0.00337	10.9	62.9	0.00604	0.189	0.00033	0	0.544
140 BOMBA CON TEMPERATURA ECOPACT	7190	195	6970	184	0.00334	10.9	62.9	0.00604	0.189	0.00033	0	0.544
140 BOMBA CON RETARDANTE Y	7190	195	6990	184	0.00336	10.9	62.9	0.00604	0.189	0.00033	0	0.544

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	81.6	0.139	434	4.94e-05	1.09	0.00282	6730
Maximum	84.7	0.144	448	5.09e-05	1.13	0.00292	6950
Mean	83.2	0.142	441	5.02e-05	1.11	0.00287	6840
Median	83.5	0.142	441	5.02e-05	1.11	0.00287	6840
180 BOMBA ECOPACT	81.8	0.139	435	4.96e-05	1.09	0.00282	6740
180 BOMBA CON TEMPERATURA ECOPACT	81.8	0.139	435	4.96e-05	1.09	0.00282	6740
180 BOMBA CON RETARDANTE ECOPACT	81.7	0.139	434	4.95e-05	1.09	0.00282	6740
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	81.6	0.139	434	4.94e-05	1.09	0.00282	6730
180 BOMBA CON FIBRA ECOPACT	83.9	0.143	447	5.08e-05	1.11	0.00291	6940
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	83.9	0.143	447	5.08e-05	1.11	0.00291	6940
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	83.9	0.143	447	5.08e-05	1.11	0.00291	6940
180 DIRECTO ECOPACT	82.5	0.14	435	4.96e-05	1.1	0.00283	6750
180 DIRECTO CON TEMPERATURA ECOPACT	82.5	0.14	435	4.96e-05	1.1	0.00283	6750
180 DIRECTO CON RETARDANTE ECOPACT	83.5	0.142	441	5.02e-05	1.11	0.00287	6840
180 DIRECTO CON RETARDANTE Y	83.5	0.142	441	5.02e-05	1.11	0.00287	6840

TEMPERATURA ECOPACT							
180 DIRECTO CON FIBRA ECOPACT	84.7	0.144	448	5.09e-05	1.13	0.00292	6950
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	84.7	0.144	448	5.09e-05	1.13	0.00292	6950
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	84.7	0.144	448	5.09e-05	1.13	0.00292	6950

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	7480	204	7270	192	0.00348	10.2	64.4	0.00623	0.178	0.000533	0	0.544
Maximum	7740	214	7550	199	0.00367	11	66.3	0.00642	0.189	0.000533	0	0.544
Mean	7620	209	7410	195	0.00358	10.5	65.5	0.00633	0.184	0.000533	0	0.544
Median	7620	209	7400	195	0.00361	10.5	65.5	0.00633	0.184	0.000533	0	0.544
180 BOMBA ECOPACT	7530	205	7290	192	0.00351	11	64.9	0.00626	0.184	0.000533	0	0.544
180 BOMBA CON TEMPERATURA ECOPACT	7520	205	7270	193	0.00354	11	64.9	0.00626	0.184	0.000533	0	0.544
180 BOMBA CON RETARDANTE ECOPACT	7500	206	7300	192	0.00358	10.8	64.6	0.00624	0.184	0.000533	0	0.544
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7480	204	7280	193	0.00348	10.6	64.4	0.00623	0.184	0.000533	0	0.544
180 BOMBA CON FIBRA ECOPACT	7710	211	7530	198	0.00367	10.6	65.9	0.00639	0.189	0.000533	0	0.544
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	7730	211	7470	198	0.00363	10.6	65.9	0.00639	0.189	0.000533	0	0.544

180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	7730	212	7510	198	0.00367	10.6	65.9	0.00639	0.189	0.000533	0	0.544
180 DIRECTO ECOPACT	7510	206	7300	193	0.0035	10.4	65.1	0.00628	0.178	0.000533	0	0.544
180 DIRECTO CON TEMPERATURA ECOPACT	7520	206	7330	193	0.00351	10.4	65.1	0.00628	0.178	0.000533	0	0.544
180 DIRECTO CON RETARDANTE ECOPACT	7630	210	7410	195	0.00361	10.2	65.5	0.00633	0.178	0.000533	0	0.544
180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7600	208	7400	195	0.00361	10.2	65.5	0.00633	0.178	0.000533	0	0.544
180 DIRECTO CON FIBRA ECOPACT	7710	214	7550	198	0.00363	10.3	66.3	0.00642	0.189	0.000533	0	0.544
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	7730	213	7530	199	0.00361	10.3	66.3	0.00642	0.189	0.000533	0	0.544
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	7740	212	7530	198	0.00361	10.3	66.3	0.00642	0.189	0.000533	0	0.544

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	92.5	0.158	497	5.59e-05	1.22	0.00324	7720
Maximum	128	0.214	673	7.31e-05	1.68	0.00445	10500
Mean	99.6	0.17	540	6.03e-05	1.31	0.00352	8390
Median	[98.3	0.168	530	5.93e-05	1.3	0.00346	8240
210 DIRECTO ECOPACT	96.2	0.163	512	5.74e-05	1.27	0.00334	7940

210 DIRECTO CON TEMPERATURA ECOPACT	96.2	0.163	512	5.74e-05	1.27	0.00334	7940
210 DIRECTO CON RETARDANTE ECOPACT	96.2	0.163	512	5.74e-05	1.27	0.00334	7940
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	96.2	0.163	512	5.74e-05	1.27	0.00334	7940
210 DIRECTO CON FIBRA ECOPACT	98.3	0.167	524	5.87e-05	1.3	0.00343	8140
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	98.3	0.167	524	5.87e-05	1.3	0.00343	8140
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	98.3	0.167	524	5.87e-05	1.3	0.00343	8140
210 BOMBA ECOPACT	93.1	0.158	498	5.6e-05	1.23	0.00325	7730
210 BOMBA CON TEMPERATURA ECOPACT	93.1	0.158	498	5.6e-05	1.23	0.00325	7730
210 BOMBA CON RETARDANTE ECOPACT	92.5	0.158	498	5.6e-05	1.22	0.00324	7730
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	92.5	0.158	498	5.6e-05	1.22	0.00324	7730
210 BOMBA CON FIBRA ECOPACT	95.4	0.162	511	5.74e-05	1.26	0.00334	7940
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	94.9	0.162	511	5.74e-05	1.25	0.00333	7940
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	95.4	0.162	511	5.74e-05	1.26	0.00334	7940
210 BOMBA PP ECOPACT	92.5	0.158	497	5.59e-05	1.22	0.00324	7720
210 BOMBA PP CON TEMPERATURA ECOPACT	92.5	0.158	497	5.59e-05	1.22	0.00324	7720
210 SEMIFLUIDO ECOPACT	98	0.167	529	5.91e-05	1.29	0.00345	8220
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	98	0.167	529	5.91e-05	1.29	0.00345	8220

210 SEMIFLUIDO CON RETARDANTE ECOPACT	98	0.167	529	5.91e-05	1.29	0.00345	8220
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	98	0.167	529	5.91e-05	1.29	0.00345	8220
210 SEMIFLUIDO CON FIBRA ECOPACT	98.5	0.168	530	5.93e-05	1.3	0.00346	8240
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	98.5	0.168	530	5.93e-05	1.3	0.00346	8240
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	98.5	0.168	530	5.93e-05	1.3	0.00346	8240
210 SEMIFLUIDO 3/8 ECOPACT	103	0.177	572	6.34e-05	1.35	0.00373	8890
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	104	0.179	578	6.41e-05	1.36	0.00377	8990
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	103	0.177	572	6.34e-05	1.35	0.00373	8890
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	104	0.179	578	6.41e-05	1.36	0.00377	8990
210 FLUIDO ECOPACT	98.2	0.168	536	6e-05	1.29	0.00349	8330
210 FLUIDO CON TEMPERATURA ECOPACT	98.2	0.168	536	6e-05	1.29	0.00349	8330
210 FLUIDO CON RETARDANTE ECOPACT	98.2	0.168	536	6e-05	1.29	0.00349	8330
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	98.2	0.168	536	6e-05	1.29	0.00349	8330
210 FLUIDO CON FIBRA ECOPACT	99.4	0.17	543	6.07e-05	1.31	0.00354	8440
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	99.3	0.17	543	6.06e-05	1.3	0.00354	8430
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	99.3	0.17	543	6.06e-05	1.3	0.00354	8430

210 FLUIDO 3/8 ECOPACT	106	0.182	591	6.54e-05	1.39	0.00385	9190
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	106	0.182	591	6.54e-05	1.39	0.00385	9190
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	106	0.182	591	6.54e-05	1.39	0.00385	9190
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	106	0.182	591	6.54e-05	1.39	0.00385	9190
210 LANZADO ECOPACT	107	0.183	598	6.62e-05	1.39	0.00389	9290
210 LANZADO CON TEMPERATURA ECOPACT	107	0.183	598	6.62e-05	1.39	0.00389	9290
210 PERMEABLE ECOPACT	128	0.214	673	7.31e-05	1.68	0.00445	10500
245 DIRECTO ECOPACT	101	0.171	536	5.98e-05	1.33	0.00351	8330
245 BOMBA ECOPACT	101	0.171	542	6.05e-05	1.33	0.00354	8420
250 DIRECTO ECOPACT	101	0.171	536	5.98e-05	1.33	0.00351	8330
250 BOMBA ECOPACT	101	0.171	542	6.05e-05	1.33	0.00354	8420

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	8590	235	8340	220	0.00396	0.995	70.4	0.00692	0.105	0.000533	0	0.544
Maximum	11600	326	11300	300	0.00562	12.6	85.6	0.00871	0.205	0.000533	0	0.544
Mean	9350	258	9090	240	0.00441	10.2	74.5	0.00739	0.189	0.000533	0	0.544
Median	9190	253	8940	236	0.00435	9.91	73.9	0.0073	0.189	0.000533	0	0.544
210 DIRECTO ECOPACT	8870	247	8630	227	0.00428	9.13	72.3	0.00711	0.178	0.000533	0	0.544
210 DIRECTO CON TEMPERATURA ECOPACT	8900	244	8580	227	0.00418	9.13	72.3	0.00711	0.178	0.000533	0	0.544

210 DIRECTO CON RETARDANTE ECOPACT	8830	246	8610	227	0.00418	9.13	72.3	0.00711	0.178	0.000533	0	0.544
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	8850	244	8590	227	0.00416	9.13	72.3	0.00711	0.178	0.000533	0	0.544
210 DIRECTO CON FIBRA ECOPACT	9080	251	8870	233	0.00429	8.95	73.5	0.00724	0.189	0.000533	0	0.544
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	9080	250	8810	233	0.00436	8.95	73.5	0.00724	0.189	0.000533	0	0.544
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	9060	252	8830	232	0.00427	8.95	73.5	0.00724	0.189	0.000533	0	0.544
210 BOMBA ECOPACT	8600	239	8360	221	0.00411	9.8	70.7	0.00694	0.184	0.000533	0	0.544
210 BOMBA CON TEMPERATURA ECOPACT	8630	238	8400	221	0.00399	9.8	70.7	0.00694	0.184	0.000533	0	0.544
210 BOMBA CON RETARDANTE ECOPACT	8590	237	8380	220	0.00412	10.4	70.6	0.00694	0.189	0.000533	0	0.544
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	8610	240	8380	221	0.00403	10.4	70.6	0.00694	0.189	0.000533	0	0.544
210 BOMBA CON FIBRA ECOPACT	8850	243	8600	227	0.00411	9.83	72.2	0.0071	0.189	0.000533	0	0.544

210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	8830	244	8590	227	0.00416	10.4	72.1	0.0071	0.189	0.000533	0	0.544
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	8850	246	8600	227	0.00417	9.83	72.2	0.0071	0.189	0.000533	0	0.544
210 BOMBA PP ECOPACT	8600	236	8340	221	0.00411	10.3	70.4	0.00692	0.184	0.000533	0	0.544
210 BOMBA PP CON TEMPERATURA ECOPACT	8610	235	8360	221	0.00396	10.3	70.4	0.00692	0.184	0.000533	0	0.544
210 SEMIFLUIDO ECOPACT	9150	253	8910	235	0.00427	9.89	73.4	0.00727	0.189	0.000533	0	0.544
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	9140	251	8890	235	0.00432	9.89	73.4	0.00727	0.189	0.000533	0	0.544
210 SEMIFLUIDO CON RETARDANTE ECOPACT	9190	253	8910	235	0.00433	9.89	73.4	0.00727	0.189	0.000533	0	0.544
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9160	252	8930	235	0.00431	9.89	73.4	0.00727	0.189	0.000533	0	0.544
210 SEMIFLUIDO CON FIBRA ECOPACT	9170	252	8920	236	0.00428	9.91	73.9	0.0073	0.2	0.000533	0	0.544
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	9170	253	8880	235	0.00438	9.91	73.9	0.0073	0.2	0.000533	0	0.544
210 SEMIFLUIDO	9180	253	8940	235	0.00436	9.91	73.9	0.0073	0.2	0.000533	0	0.544

CON FRIBRA Y TEMPERATURA ECOPACT												
210 SEMIFLUIDO 3/8 ECOPACT	9910	275	9650	255	0.00467	11.6	76.7	0.00769	0.2	0.00053	0	0.544
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	10000	276	9740	257	0.0047	11.6	77.4	0.00777	0.2	0.00053	0	0.544
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	9910	272	9620	254	0.00468	11.6	76.7	0.00769	0.2	0.00053	0	0.544
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	9990	275	9760	257	0.00468	11.6	77.4	0.00777	0.2	0.00053	0	0.544
210 FLUIDO ECOPACT	9290	257	8990	238	0.00441	11.4	74.3	0.00737	0.194	0.00053	0	0.544
210 FLUIDO CON TEMPERATURA ECOPACT	9270	258	9000	238	0.00434	11.4	74.3	0.00737	0.194	0.00053	0	0.544
210 FLUIDO CON RETARDANTE ECOPACT	9240	256	9020	238	0.00433	11.4	74.3	0.00737	0.194	0.00053	0	0.544
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9280	255	9050	238	0.00447	11.4	74.3	0.00737	0.194	0.00053	0	0.544
210 FLUIDO CON FIBRA ECOPACT	9410	258	9170	241	0.00444	11.4	75.1	0.00745	0.194	0.00053	0	0.544
210 FLUIDO CON FIBRA Y	9390	259	9150	241	0.00442	11.3	75	0.00744	0.194	0.00053	0	0.544

RETARDANTE ECOPACT												
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9400	261	9090	240	0.00435	11.3	75	0.00744	0.194	0.000533	0	0.544
210 FLUIDO 3/8 ECOPACT	10200	284	9970	263	0.00485	11.6	78.6	0.00791	0.205	0.000533	0	0.544
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	10200	281	9980	263	0.00479	11.6	78.6	0.00791	0.205	0.000533	0	0.544
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	10300	283	9930	262	0.00474	11.6	78.6	0.00791	0.205	0.000533	0	0.544
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10300	283	9920	262	0.00475	11.6	78.6	0.00791	0.205	0.000533	0	0.544
210 LANZADO ECOPACT	10400	285	10100	265	0.00494	12.6	79.3	0.00799	0.184	0.000533	0	0.544
210 LANZADO CON TEMPERATURA ECOPACT	10400	288	10100	266	0.00488	12.6	79.3	0.00799	0.184	0.000533	0	0.544
210 PERMEABLE ECOPACT	11600	326	11300	300	0.00562	0.995	85.6	0.00871	0.105	0.000533	0	0.544
245 DIRECTO ECOPACT	9260	257	9020	238	0.00438	8.36	74.4	0.00736	0.184	0.000533	0	0.544
245 BOMBA ECOPACT	9380	257	9100	240	0.00444	9.31	74.7	0.00741	0.189	0.000533	0	0.544
250 DIRECTO ECOPACT	9300	258	9000	239	0.00436	8.36	74.4	0.00736	0.184	0.000533	0	0.544
250 BOMBA ECOPACT	9400	261	9160	241	0.00444	9.31	74.7	0.00741	0.189	0.000533	0	0.544

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	109	0.184	581	6.44e-05	1.43	0.00381	9020
Maximum	132	0.224	720	7.86e-05	1.72	0.00473	11200
Mean	116	0.197	632	6.97e-05	1.52	0.00414	9830
Median	113	0.193	619	6.84e-05	1.48	0.00405	9620
280 DIRECTO ECOPACT	109	0.184	581	6.44e-05	1.43	0.00381	9020
280 DIRECTO CON TEMPERATURA ECOPACT	109	0.184	581	6.44e-05	1.43	0.00381	9020
280 DIRECTO CON RETARDANTE ECOPACT	109	0.184	581	6.44e-05	1.43	0.00381	9020
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	109	0.184	581	6.44e-05	1.43	0.00381	9020
280 DIRECTO CON FIBRA ECOPACT	110	0.186	588	6.51e-05	1.45	0.00385	9130
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	110	0.186	588	6.51e-05	1.45	0.00385	9130
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	110	0.186	588	6.51e-05	1.45	0.00385	9130
280 BOMBA ECOPACT	112	0.19	606	6.69e-05	1.47	0.00397	9410
280 BOMBA CON TEMPERATURA ECOPACT	112	0.19	606	6.69e-05	1.47	0.00397	9410
280 BOMBA CON RETARDANTE ECOPACT	112	0.19	606	6.69e-05	1.47	0.00397	9410
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	112	0.19	606	6.69e-05	1.47	0.00397	9410
280 BOMBA CON FIBRA ECOPACT	113	0.192	613	6.76e-05	1.49	0.00402	9520

280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	113	0.192	613	6.76e-05	1.49	0.00402	9520
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	113	0.192	613	6.76e-05	1.49	0.00402	9520
280 BOMBA PP ECOPACT	111	0.189	606	6.69e-05	1.46	0.00396	9410
280 BOMBA PP CON TEMPERATURA ECOPACT	111	0.189	606	6.69e-05	1.46	0.00396	9410
280 SEMIFLUIDO ECOPACT	112	0.191	612	6.76e-05	1.46	0.004	9520
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	112	0.191	612	6.76e-05	1.46	0.004	9520
280 SEMIFLUIDO CON RETARDANTE ECOPACT	112	0.191	612	6.76e-05	1.46	0.004	9520
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	112	0.191	612	6.76e-05	1.46	0.004	9520
280 SEMIFLUIDO CON FIBRA ECOPACT	113	0.193	619	6.84e-05	1.48	0.00405	9620
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	113	0.193	619	6.84e-05	1.48	0.00405	9620
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	113	0.193	619	6.84e-05	1.48	0.00405	9620
280 SEMIFLUIDO 3/8 ECOPACT	118	0.202	649	7.13e-05	1.55	0.00425	10100
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	119	0.204	656	7.2e-05	1.56	0.0043	10200
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	118	0.202	649	7.13e-05	1.55	0.00425	10100
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	119	0.204	656	7.2e-05	1.56	0.0043	10200
280 FLUIDO ECOPACT	114	0.194	625	6.9e-05	1.48	0.00408	9720

280 FLUIDO CON TEMPERATURA ECOPACT	114	0.194	625	6.9e-05	1.48	0.00408	9720
280 FLUIDO CON RETARDANTE ECOPACT	115	0.196	631	6.97e-05	1.5	0.00413	9820
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	115	0.196	631	6.97e-05	1.5	0.00413	9820
280 FLUIDO CON FIBRA ECOPACT	115	0.196	632	6.97e-05	1.5	0.00413	9820
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	115	0.196	632	6.97e-05	1.5	0.00413	9820
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	115	0.196	632	6.97e-05	1.5	0.00413	9820
280 FLUIDO 3/8 ECOPACT	122	0.209	674	7.39e-05	1.6	0.00442	10500
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	122	0.209	674	7.39e-05	1.6	0.00442	10500
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	122	0.209	674	7.39e-05	1.6	0.00442	10500
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	122	0.209	674	7.39e-05	1.6	0.00442	10500
280 LANZADO ECOPACT	122	0.21	684	7.54e-05	1.58	0.00446	10600
280 LANZADO CON TEMPERATURA ECOPACT	121	0.208	680	7.46e-05	1.57	0.00444	10600
300 BOMBA ECOPACT	132	0.224	720	7.86e-05	1.72	0.00473	11200
300 BOMBA CON RETARDANTE ECOPACT	132	0.224	720	7.86e-05	1.72	0.00473	11200
300 BOMBA CON TEMPERATURA ECOPACT	132	0.224	720	7.86e-05	1.72	0.00473	11200
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	132	0.224	720	7.86e-05	1.72	0.00473	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	10000	277	9770	258	0.00472	7.19	78.5	0.00784	0.184	0.000533	0	0.544
Maximum	12500	352	12200	322	0.00601	13.1	91.5	0.00935	0.205	0.000533	0	0.544
Mean	11000	304	10600	281	0.00516	9.05	83.2	0.0084	0.198	0.000533	0	0.544
Median	10700	298	10400	275	0.00506	9.03	82.1	0.00827	0.2	0.000533	0	0.544
280 DIRECTO ECOPACT	10000	277	9770	258	0.00479	7.64	78.5	0.00784	0.184	0.000533	0	0.544
280 DIRECTO CON TEMPERATURA ECOPACT	10000	279	9770	259	0.00472	7.64	78.5	0.00784	0.184	0.000533	0	0.544
280 DIRECTO CON RETARDANTE ECOPACT	10000	278	9770	258	0.00472	7.64	78.5	0.00784	0.184	0.000533	0	0.544
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	10000	280	9780	258	0.00474	7.64	78.5	0.00784	0.184	0.000533	0	0.544
280 DIRECTO CON FIBRA ECOPACT	10200	281	9890	261	0.00479	7.66	79.3	0.00792	0.189	0.000533	0	0.544
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	10200	283	9900	262	0.00478	7.66	79.3	0.00792	0.189	0.000533	0	0.544
280 DIRECTO CON FRIBRA Y TEMPERATU	10200	283	9920	261	0.00485	7.66	79.3	0.00792	0.189	0.000533	0	0.544

RA ECOPACT												
280 BOMBA ECOPACT	10500	293	10200	270	0.00496	8.2	80.6	0.00809	0.2	0.000533	0	0.544
280 BOMBA CON TEMPERATURA ECOPACT	10500	291	10200	269	0.00492	8.2	80.6	0.00809	0.2	0.000533	0	0.544
280 BOMBA CON RETARDANTE ECOPACT	10500	289	10200	268	0.00486	8.19	80.6	0.00809	0.194	0.000533	0	0.544
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10500	290	10200	269	0.0049	8.19	80.6	0.00809	0.194	0.000533	0	0.544
280 BOMBA CON FIBRA ECOPACT	10600	295	10300	272	0.00509	8.21	81.4	0.00818	0.2	0.000533	0	0.544
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	10600	292	10300	272	0.00498	8.21	81.4	0.00818	0.2	0.000533	0	0.544
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	10600	295	10300	273	0.00504	8.21	81.4	0.00818	0.2	0.000533	0	0.544
280 BOMBA PP ECOPACT	10500	292	10100	269	0.00493	9.05	80.6	0.00809	0.2	0.000533	0	0.544
280 BOMBA PP CON TEMPERATURA ECOPACT	10500	289	10200	270	0.00489	9.05	80.6	0.00809	0.2	0.000533	0	0.544
280 SEMIFLUIDO ECOPACT	10600	294	10300	272	0.00492	10	81.3	0.00818	0.2	0.000533	0	0.544
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	10600	293	10300	271	0.00493	10	81.3	0.00818	0.2	0.000533	0	0.544
280 SEMIFLUIDO	10600	293	10300	272	0.00494	10	81.3	0.00818	0.2	0.000533	0	0.544

CON RETARDANTE ECOPACT												
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	10600	294	10300	271	0.00498	10	81.3	0.00818	0.2	0.000533	0	0.544
280 SEMIFLUIDO CON FIBRA ECOPACT	10700	300	10400	275	0.00505	10	82.1	0.00827	0.205	0.000533	0	0.544
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	10700	295	10500	275	0.00504	10	82.1	0.00827	0.205	0.000533	0	0.544
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	10700	298	10400	275	0.00506	10	82.1	0.00827	0.205	0.000533	0	0.544
280 SEMIFLUIDO 3/8 ECOPACT	11200	316	10900	289	0.00523	9.06	84.4	0.00856	0.2	0.000533	0	0.544
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	11400	313	11000	292	0.00537	9.06	85.1	0.00863	0.2	0.000533	0	0.544
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	11300	313	10900	289	0.00532	9.06	84.4	0.00856	0.2	0.000533	0	0.544
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	11400	314	11000	292	0.0054	9.06	85.1	0.00863	0.2	0.000533	0	0.544

280 FLUIDO ECOPACT	10900	299	10600	277	0.00512	10.4	82.6	0.00833	0.2	0.000533	0	0.544
280 FLUIDO CON TEMPERATURA ECOPACT	10800	303	10500	277	0.00513	10.4	82.6	0.00833	0.2	0.000533	0	0.544
280 FLUIDO CON RETARDANTE ECOPACT	10900	302	10600	281	0.00515	10.5	83.2	0.0084	0.2	0.000533	0	0.544
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	11000	305	10600	281	0.00513	10.5	83.2	0.0084	0.2	0.000533	0	0.544
280 FLUIDO CON FIBRA ECOPACT	10900	304	10600	281	0.00503	10.5	83.3	0.00841	0.205	0.000533	0	0.544
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	10900	307	10600	281	0.0052	10.5	83.3	0.00841	0.205	0.000533	0	0.544
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	11000	303	10600	281	0.00524	10.5	83.3	0.00841	0.205	0.000533	0	0.544
280 FLUIDO 3/8 ECOPACT	11700	322	11400	300	0.0055	9.01	86.6	0.00882	0.2	0.000533	0	0.544
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	11700	327	11400	300	0.00554	9.01	86.6	0.00882	0.2	0.000533	0	0.544
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	11700	327	11300	299	0.00548	9.01	86.6	0.00882	0.2	0.000533	0	0.544
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	11700	327	11400	301	0.00557	9.01	86.6	0.00882	0.2	0.000533	0	0.544

280 LANZADO ECOPACT	11900	329	11500	304	0.00562	13.1	89	0.00905	0.2	0.000533	0	0.544
280 LANZADO CON TEMPERATURA ECOPACT	11900	327	11500	303	0.00552	11.8	87.1	0.0089	0.2	0.000533	0	0.544
300 BOMBA ECOPACT	12500	349	12100	322	0.00593	7.19	91.5	0.00935	0.2	0.000533	0	0.544
300 BOMBA CON RETARDANTE ECOPACT	12500	348	12100	321	0.00578	7.19	91.5	0.00935	0.2	0.000533	0	0.544
300 BOMBA CON TEMPERATURA ECOPACT	12500	352	12200	320	0.00601	7.19	91.5	0.00935	0.2	0.000533	0	0.544
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12500	348	12100	321	0.00598	7.19	91.5	0.00935	0.2	0.000533	0	0.544

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	128	0.218	701	7.66e-05	1.67	0.0046	10900
Maximum	136	0.231	746	8.12e-05	1.77	0.0049	11600
Mean	133	0.225	727	7.92e-05	1.73	0.00477	11300
Median	134	0.227	733	7.99e-05	1.74	0.00481	11400
350 BOMBA ECOPACT	134	0.227	733	7.99e-05	1.74	0.00481	11400
350 BOMBA CON RETARDANTE ECOPACT	134	0.227	733	7.99e-05	1.74	0.00481	11400
350 BOMBA CON TEMPERATURA ECOPACT	134	0.227	733	7.99e-05	1.74	0.00481	11400

350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	134	0.227	733	7.99e-05	1.74	0.00481	11400
350 SEMIFLUIDO ECOPACT	128	0.218	701	7.66e-05	1.67	0.0046	10900
350 SEMIFLUIDO CON RETARDANTE ECOPACT	128	0.218	701	7.66e-05	1.67	0.0046	10900
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	128	0.218	701	7.66e-05	1.67	0.0046	10900
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	128	0.218	701	7.66e-05	1.67	0.0046	10900
350 FLUIDO ECOPACT	136	0.231	746	8.12e-05	1.77	0.0049	11600
350 FLUIDO CON RETARDANTE ECOPACT	136	0.231	746	8.12e-05	1.77	0.0049	11600
350 FLUIDO CON TEMPERATURA ECOPACT	136	0.231	746	8.12e-05	1.77	0.0049	11600
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	136	0.231	746	8.12e-05	1.77	0.0049	11600

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	12100	336	11800	312	0.0056	7.72	89.4	0.00913	0.2	0.000533	0	0.544
Maximum	13000	362	12600	333	0.00612	7.9	93.9	0.00963	0.205	0.000533	0	0.544
Mean	12600	351	12200	324	0.00593	7.79	92.1	0.00942	0.203	0.000533	0	0.544
Median	12700	354	12400	326	0.00598	7.82	92.8	0.0095	0.205	0.000533	0	0.544
350 BOMBA ECOPACT	12700	355	12300	327	0.00604	7.72	92.8	0.0095	0.2	0.000533	0	0.544
350 BOMBA CON RETARDANTE ECOPACT	12700	356	12400	326	0.00594	7.72	92.8	0.0095	0.2	0.000533	0	0.544
350 BOMBA CON	12700	353	12300	326	0.00606	7.72	92.8	0.0095	0.2	0.000533	0	0.544

TEMPERATURA ECOPACT												
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12700	352	12400	327	0.00598	7.72	92.8	0.0095	0.2	0.000533	0	0.544
350 SEMIFLUIDO ECOPACT	12100	338	11800	312	0.00574	7.9	89.6	0.00914	0.205	0.000533	0	0.544
350 SEMIFLUIDO CON RETARDANTE ECOPACT	12200	336	11800	312	0.00567	7.85	89.5	0.00914	0.205	0.000533	0	0.544
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	12200	341	11800	313	0.0056	7.85	89.5	0.00914	0.205	0.000533	0	0.544
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12100	337	11800	312	0.00579	7.77	89.4	0.00913	0.205	0.000533	0	0.544
350 FLUIDO ECOPACT	13000	361	12600	332	0.00612	7.82	93.9	0.00963	0.205	0.000533	0	0.544
350 FLUIDO CON RETARDANTE ECOPACT	12900	360	12600	332	0.00612	7.82	93.9	0.00963	0.205	0.000533	0	0.544
350 FLUIDO CON TEMPERATURA ECOPACT	12900	361	12600	332	0.00598	7.82	93.9	0.00963	0.205	0.000533	0	0.544
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	13000	362	12600	333	0.00609	7.82	93.9	0.00963	0.205	0.000533	0	0.544

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	127	0.216	695	7.61e-05	1.66	0.00456	10800
Maximum	130	0.222	714	7.8e-05	1.7	0.00469	11100
Mean	129	0.22	708	7.74e-05	1.69	0.00465	11000
Median	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 BOMBA ECOPACT	127	0.216	695	7.61e-05	1.66	0.00456	10800
420 BOMBA CON RETARDANTE ECOPACT	127	0.216	695	7.61e-05	1.66	0.00456	10800
420 BOMBA CON TEMPERATURA ECOPACT	127	0.216	695	7.61e-05	1.66	0.00456	10800
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	127	0.216	695	7.61e-05	1.66	0.00456	10800
420 SEMIFLUIDO ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 SEMIFLUIDO CON RETARDANTE ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 FLUIDO ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 FLUIDO CON RETARDANTE ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 FLUIDO CON TEMPERATURA ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	130	0.222	714	7.8e-05	1.7	0.00469	11100

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	12000	337	11700	309	0.00556	7.91	89.3	0.00909	0.2	0.000533	0	0.544
Maximum	12500	348	12100	319	0.006	7.97	90.9	0.00929	0.2	0.000533	0	0.544
Mean	12300	343	11900	315	0.00579	7.93	90.4	0.00922	0.2	0.000533	0	0.544
Median	12400	344	12000	318	0.00578	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 BOMBA ECOPACT	12000	337	11700	310	0.00571	7.97	89.3	0.00909	0.2	0.000533	0	0.544
420 BOMBA CON RETARDANTE ECOPACT	12000	338	11700	309	0.00564	7.97	89.3	0.00909	0.2	0.000533	0	0.544
420 BOMBA CON TEMPERATURA ECOPACT	12100	338	11700	309	0.00556	7.97	89.3	0.00909	0.2	0.000533	0	0.544
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12000	341	11700	309	0.00568	7.97	89.3	0.00909	0.2	0.000533	0	0.544
420 SEMIFLUIDO ECOPACT	12400	344	12100	318	0.00578	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 SEMIFLUIDO CON RETARDANTE ECOPACT	12400	346	12000	319	0.006	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	12400	344	12100	318	0.00584	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 SEMIFLUIDO CON RETARDANT	12500	347	12000	317	0.00591	7.91	90.9	0.00929	0.2	0.000533	0	0.544

E Y TEMPERATURA ECOPACT												
420 FLUIDO ECOPACT	12400	346	12000	318	0.00571	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 FLUIDO CON RETARDANTE ECOPACT	12400	344	12000	317	0.00594	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 FLUIDO CON TEMPERATURA ECOPACT	12400	348	12000	318	0.00578	7.91	90.9	0.00929	0.2	0.000533	0	0.544
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12400	341	12100	318	0.0059	7.91	90.9	0.00929	0.2	0.000533	0	0.544

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.