

ENVIRONMENTAL PRODUCT DECLARATION



Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT SAN ANDRÉS** facility in La Libertad, El Salvador.

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 Rule (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 <input type="checkbox"/> ; External <input checked="" type="checkbox"/>
	Third Party Verifier Geoffrey Guest, Certified 3rd Party Verifier under the International EPD Program (www.environdec.com), CSA Group (www.csaregistry.ca)
Date of Issue:	9 January 2023
Period of Validity:	5 years; valid until 9 January 2028
EPD Number:	acf0fc60-4579-48a9-af8f-b77daga0c677



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COMPANY DESCRIPTION

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

STUDY GOAL

The intended application of this life cycle assessment (LCA) is to comply with the procedures for creating a Type III environmental product declaration (EPD) and publish the EPD for public review on the website, <http://labelingsustainability.com/>. This level of study is in accordance with EPD Product Category Rule (PCR) for Ready Mix Concrete published by NSF International (2019) and is a sub-PCR of International Standards Organization (ISO) 21930:2017 Sustainability in buildings and civil works - Core rules for EPDs of construction products and services; International Standards Organization (ISO) 14025:2006 Environmental labels and declarations, Type III environmental declarations-Principles and procedures; ISO 14044:2006 Environmental management, Life cycle assessment- Requirements and guidelines; and ISO 14040:2006 Environmental management, Life cycle assessment-Principles and framework. The performance of this study and its subsequent publishing is in alignment with the business-to-business (B2B) communication requirements for the environmental assessment of building products. The study does not intend to support comparative assertions and is intended to be disclosed to the public.

This project report was commissioned to differentiate Holcim El Salvador from their competition for the following reasons: generate an advantage for the organization; offer customers information to help them make informed product decisions; improve the environmental performance of Holcim El Salvador by continuously measuring, controlling and reducing the environmental impacts of their products; help project facilitators working on Leadership in Energy and Environmental Design (LEED) projects achieve their credit goal; and to strengthen Holcim El Salvador's license to operate in the community. The intended audience for this LCA report is Holcim El Salvador's employees, their suppliers, project specifiers of their products, architects, and engineers. The EPD report is also available for policy makers, government officials interested in sustainability, academic professors, and LCA professionals. This LCA report does not include product comparisons from other facilities.

DESCRIPTION OF PRODUCT AND SCOPE

This EPD reports on 149 concrete mixes manufactured at the Holcim El Salvador concrete facility in La Libertad, 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	H ₂ O 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	H ₂ O 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	H ₂ O 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	H ₂ O 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
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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	H ₂ O 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:

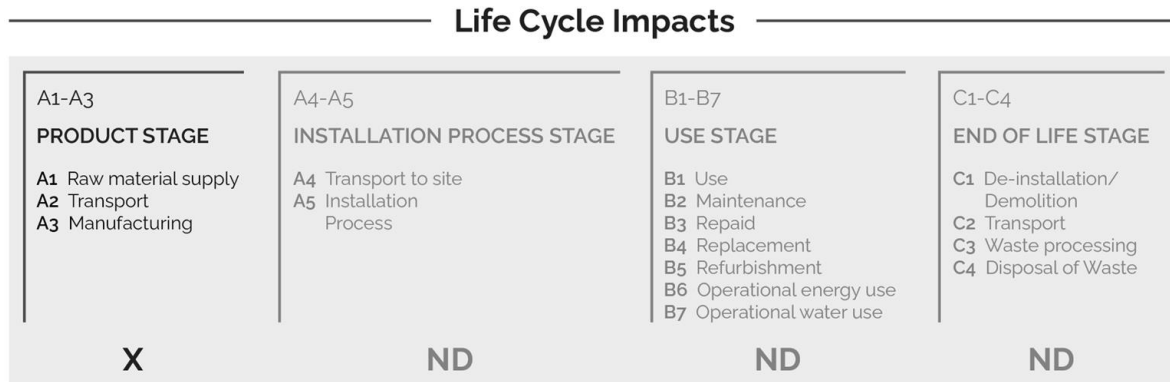


Figure 1: General life cycle phases for consideration in a construction works system.

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.

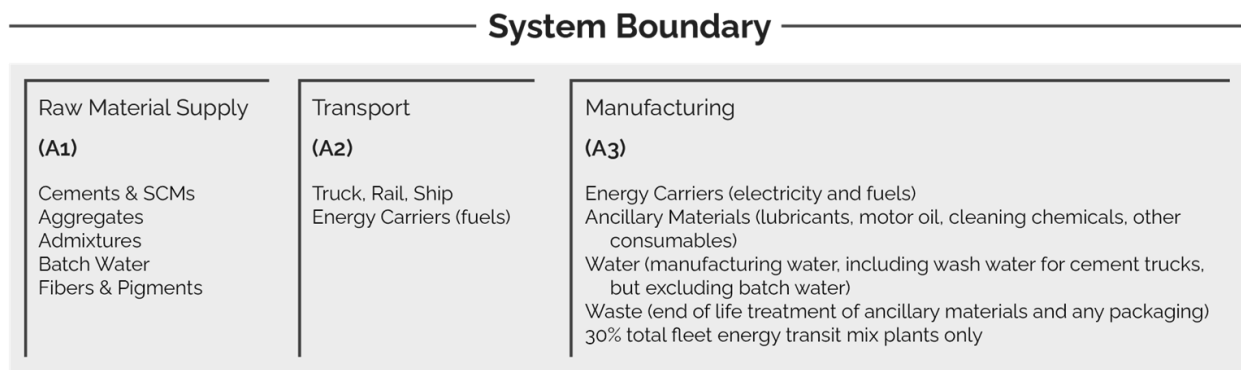


Figure 2: General system inputs considered in the product system and categorized by modules in scope



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 San Andres 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 g: 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
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 November 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 CO ₂ -Eq	kg CFC-11-Eq	kg NO _x -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	67.8	0.123	354	3.87e-05	0.908	0.00228	5480
Maximum	77.4	0.139	403	4.37e-05	1.03	0.00263	6300
Mean	72.4	0.13	377	4.1e-05	0.966	0.00244	5850
Median	71.2	0.128	368	4.02e-05	0.954	0.00238	5700
100 BOMBA ECOPACT	67.8	0.123	354	3.87e-05	0.908	0.00228	5480
100 BOMBA CON TEMPERATURA ECOPACT	67.8	0.123	354	3.87e-05	0.908	0.00228	5480
100 BOMBA CON RETARDANTE ECOPACT	68	0.123	355	3.88e-05	0.91	0.00229	5490
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	68	0.123	355	3.88e-05	0.91	0.00229	5490
100 BOMBA CON FIBRA ECOPACT	70.1	0.127	367	4e-05	0.936	0.00236	5680



100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	70.2	0.127	368	4.01e-05	0.937	0.00237	5690
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	70.1	0.127	367	4e-05	0.936	0.00236	5680
100 DIRECTO ECOPACT	68.7	0.124	355	3.88e-05	0.922	0.00229	5480
100 DIRECTO CON TEMPERATURA ECOPACT	68.7	0.124	355	3.88e-05	0.922	0.00229	5480
100 DIRECTO CON RETARDANTE ECOPACT	71.2	0.128	368	4.03e-05	0.955	0.00238	5700
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	71.2	0.128	368	4.03e-05	0.955	0.00238	5700
100 DIRECTO CON FIBRA ECOPACT	71.2	0.128	368	4.02e-05	0.954	0.00237	5690
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	71.3	0.128	369	4.03e-05	0.956	0.00238	5710
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	71.2	0.128	368	4.02e-05	0.954	0.00237	5690
140 DIRECTO ECOPACT	76.8	0.138	402	4.34e-05	1.02	0.00262	6270
140 DIRECTO CON RETARDANTE ECOPACT	76.9	0.138	402	4.35e-05	1.02	0.00262	6280
140 DIRECTO CON TEMPERATURA ECOPACT	76.8	0.138	402	4.34e-05	1.02	0.00262	6270
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	76.9	0.138	402	4.35e-05	1.02	0.00262	6280
140 BOMBA ECOPACT	77.3	0.139	403	4.37e-05	1.03	0.00263	6290
140 BOMBA CON RETARDANTE ECOPACT	77.4	0.139	403	4.37e-05	1.03	0.00263	6300
140 BOMBA CON TEMPERATURA ECOPACT	77.3	0.139	403	4.37e-05	1.03	0.00263	6290
140 BOMBA CON RETARDANTE Y	77.4	0.139	403	4.37e-05	1.03	0.00263	6300



TEMPERATURA ECOPACT												
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b) Inventory Metrics:

Indicator/LC I Metric	TPE	RE	NRE	NR R	RR	WD P	LFW	LFHW	CBW C	CWWC	CH W	CNH W
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	6100	192	5910	156	0.00301	10.6	50.7	0.00463	0.178	0.000248	0	6.24
Maximum	7040	220	6830	180	0.00354	12	55.2	0.00516	0.189	0.000248	0	6.24
Mean	6540	205	6330	167	0.00325	11.5	52.8	0.00488	0.185	0.000248	0	6.24
Median	6360	201	6160	163	0.0032	11.8	52.3	0.00481	0.184	0.000248	0	6.24
100 BOMBA ECOPACT	6140	195	5930	156	0.00304	12	50.7	0.00463	0.184	0.000248	0	6.24
100 BOMBA CON TEMPERATURA ECOPACT	6100	193	5930	156	0.00305	12	50.7	0.00463	0.184	0.000248	0	6.24
100 BOMBA CON RETARDANTE ECOPACT	6140	194	5930	157	0.00303	12	50.7	0.00464	0.184	0.000248	0	6.24
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	6140	192	5940	157	0.00301	12	50.7	0.00464	0.184	0.000248	0	6.24
100 BOMBA CON FIBRA ECOPACT	6320	201	6130	162	0.00314	12	51.8	0.00477	0.189	0.000248	0	6.24
100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	6360	201	6160	163	0.00312	12	51.9	0.00477	0.189	0.000248	0	6.24
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	6340	200	6130	163	0.00315	12	51.8	0.00477	0.189	0.000248	0	6.24
100 DIRECTO ECOPACT	6140	195	5910	156	0.00307	11.4	50.8	0.00464	0.178	0.000248	0	6.24
100 DIRECTO CON TEMPERATURA ECOPACT	6150	194	5920	157	0.00311	11.4	50.8	0.00464	0.178	0.000248	0	6.24





100 DIRECTO CON RETARDANTE ECOPACT	6380	201	6160	163	0.00319	11.8	52.3	0.00481	0.178	0.000248	0	6.24
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	6370	201	6190	163	0.0032	11.8	52.3	0.00481	0.178	0.000248	0	6.24
100 DIRECTO CON FIBRA ECOPACT	6360	201	6180	163	0.0032	11.9	52.3	0.00481	0.189	0.000248	0	6.24
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	6390	200	6170	164	0.00316	11.9	52.4	0.00482	0.184	0.000248	0	6.24
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	6350	201	6160	162	0.00321	11.9	52.3	0.00481	0.189	0.000248	0	6.24
140 DIRECTO ECOPACT	7010	218	6760	179	0.00343	10.6	54.7	0.00511	0.184	0.000248	0	6.24
140 DIRECTO CON RETARDANTE ECOPACT	7020	220	6810	180	0.0035	10.6	54.7	0.00512	0.184	0.000248	0	6.24
140 DIRECTO CON TEMPERATURA ECOPACT	7030	218	6780	179	0.00345	10.6	54.7	0.00511	0.184	0.000248	0	6.24
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7030	218	6800	180	0.00352	10.6	54.7	0.00512	0.184	0.000248	0	6.24
140 BOMBA ECOPACT	7030	218	6830	180	0.00351	10.9	55.2	0.00515	0.189	0.000248	0	6.24
140 BOMBA CON RETARDANTE ECOPACT	7030	218	6810	180	0.00343	10.9	55.2	0.00516	0.189	0.000248	0	6.24
140 BOMBA CON TEMPERATURA ECOPACT	7040	219	6820	180	0.00351	10.9	55.2	0.00515	0.189	0.000248	0	6.24
140 BOMBA CON RETARDANTE Y	7040	218	6810	180	0.00354	10.9	55.2	0.00516	0.189	0.000248	0	6.24



TEMPERATURA ECOPACT											
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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	80.9	0.145	424	4.58e-05	1.07	0.00277	6630
Maximum	83.8	0.149	437	4.72e-05	1.11	0.00286	6850
Mean	82.3	0.147	430	4.65e-05	1.09	0.00282	6740
Median	82.7	0.147	431	4.65e-05	1.1	0.00282	6750
180 BOMBA ECOPACT	80.9	0.145	424	4.59e-05	1.07	0.00277	6630
180 BOMBA CON TEMPERATURA ECOPACT	80.9	0.145	424	4.59e-05	1.07	0.00277	6630
180 BOMBA CON RETARDANTE ECOPACT	81	0.145	424	4.59e-05	1.07	0.00278	6650
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	80.9	0.145	424	4.58e-05	1.07	0.00277	6650
180 BOMBA CON FIBRA ECOPACT	82.9	0.148	436	4.7e-05	1.1	0.00285	6820
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	83.1	0.148	437	4.71e-05	1.1	0.00286	6840
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	82.9	0.148	436	4.7e-05	1.1	0.00285	6820
180 DIRECTO ECOPACT	81.5	0.145	424	4.59e-05	1.08	0.00277	6630
180 DIRECTO CON TEMPERATURA ECOPACT	81.5	0.145	424	4.59e-05	1.08	0.00277	6630
180 DIRECTO CON RETARDANTE ECOPACT	82.7	0.147	431	4.65e-05	1.1	0.00282	6750
180 DIRECTO CON RETARDANTE Y	82.7	0.147	431	4.65e-05	1.1	0.00282	6750



TEMPERATURA ECOPACT							
180 DIRECTO CON FIBRA ECOPACT	83.7	0.149	436	4.71e-05	1.11	0.00286	6830
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	83.8	0.149	437	4.72e-05	1.11	0.00286	6850
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	83.7	0.149	436	4.71e-05	1.11	0.00286	6830

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NR	RR	WDP	LFW	LFHW	CBWC	CWWC	CHW	CNH
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	7400	229	7170	189	0.00362	10.3	57.3	0.00539	0.178	0.000248	0	6.24
Maximum	7670	239	7420	196	0.00383	11	58.6	0.00554	0.189	0.000248	0	6.24
Mean	7530	234	7290	193	0.00373	10.6	58	0.00546	0.184	0.000248	0	6.24
Median	7560	234	7320	193	0.00372	10.5	58	0.00547	0.184	0.000248	0	6.24
180 BOMBA ECOPACT	7410	232	7170	190	0.00374	11	57.5	0.0054	0.184	0.000248	0	6.24
180 BOMBA CON TEMPERATURA ECOPACT	7400	230	7190	189	0.00364	11	57.5	0.0054	0.184	0.000248	0	6.24
180 BOMBA CON RETARDANTE ECOPACT	7470	231	7180	190	0.00369	10.8	57.4	0.0054	0.184	0.000248	0	6.24
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7430	229	7190	190	0.0037	10.6	57.3	0.00539	0.184	0.000248	0	6.24
180 BOMBA CON FIBRA ECOPACT	7600	234	7380	195	0.00377	10.7	58.3	0.00551	0.189	0.000248	0	6.24
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	7630	235	7420	195	0.00383	10.7	58.4	0.00552	0.189	0.000248	0	6.24



180 BOMBA CON FRIBRA Y TEMPERATU RA ECOPACT	762 0	23 7	741 0	195	0.0038 2	10.7	58.3	0.0055 1	0.189	0.00024 8	0	6.24
180 DIRECTO ECOPACT	742 0	23 2	717 0	190	0.0036 2	10.4	57.5	0.0054	0.178	0.00024 8	0	6.24
180 DIRECTO CON TEMPERATU RA ECOPACT	745 0	231	719 0	190	0.0036 4	10.4	57.5	0.0054	0.178	0.00024 8	0	6.24
180 DIRECTO CON RETARDANT E ECOPACT	756 0	23 4	731 0	193	0.0037 1	10.3	58	0.0054 7	0.178	0.00024 8	0	6.24
180 DIRECTO CON RETARDANT E Y TEMPERATU RA ECOPACT	755 0	23 5	732 0	193	0.0037 7	10.3	58	0.0054 7	0.178	0.00024 8	0	6.24
180 DIRECTO CON FIBRA ECOPACT	763 0	23 9	738 0	195	0.0037 5	10.3	58.5	0.0055 3	0.189	0.00024 8	0	6.24
180 DIRECTO CON FIBRA Y RETARDANT E ECOPACT	767 0	23 9	738 0	196	0.0037	10.3	58.6	0.0055 4	0.189	0.00024 8	0	6.24
180 DIRECTO CON FRIBRA Y TEMPERATU RA ECOPACT	760 0	23 6	738 0	196	0.0037 9	10.3	58.5	0.0055 3	0.189	0.00024 8	0	6.24

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 CO ₂ -Eq	kg CFC-11-Eq	kg NO _x -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	91	0.162	484	5.17e-05	1.2	0.00316	7560
Maximum	126	0.217	654	6.82e-05	1.65	0.00432	10200
Mean	98.4	0.174	527	5.61e-05	1.29	0.00346	8260
Median	97.4	0.173	519	5.54e-05	1.28	0.00341	8150
210 DIRECTO ECOPACT	94.5	0.167	496	5.3e-05	1.25	0.00325	7730



210 DIRECTO CON TEMPERATURA ECOPACT	94.5	0.167	496	5.3e-05	1.25	0.00325	7730
210 DIRECTO CON RETARDANTE ECOPACT	94.6	0.167	497	5.31e-05	1.25	0.00325	7750
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	94.6	0.167	497	5.31e-05	1.25	0.00325	7750
210 DIRECTO CON FIBRA ECOPACT	96.6	0.171	509	5.43e-05	1.28	0.00333	7930
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	96.7	0.171	509	5.43e-05	1.28	0.00334	7950
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	96.6	0.171	509	5.43e-05	1.28	0.00333	7930
210 BOMBA ECOPACT	91.9	0.163	485	5.19e-05	1.21	0.00318	7590
210 BOMBA CON TEMPERATURA ECOPACT	91.9	0.163	485	5.19e-05	1.21	0.00318	7590
210 BOMBA CON RETARDANTE ECOPACT	91.8	0.163	487	5.22e-05	1.21	0.0032	7650
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	91.8	0.163	487	5.22e-05	1.21	0.0032	7650
210 BOMBA CON FIBRA ECOPACT	94.1	0.167	498	5.32e-05	1.24	0.00326	7790
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	94	0.167	500	5.35e-05	1.24	0.00328	7850
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	94.1	0.167	498	5.32e-05	1.24	0.00326	7790
210 BOMBA PP ECOPACT	91	0.162	484	5.17e-05	1.2	0.00316	7560
210 BOMBA PP CON TEMPERATURA ECOPACT	91	0.162	484	5.17e-05	1.2	0.00316	7560
210 SEMIFLUIDO ECOPACT	97.1	0.172	518	5.52e-05	1.28	0.0034	8120
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	97.1	0.172	518	5.52e-05	1.28	0.0034	8120



210 SEMIFLUIDO CON RETARDANTE ECOPACT	97.3	0.172	519	5.53e-05	1.28	0.00341	8150
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	97.3	0.172	519	5.53e-05	1.28	0.00341	8150
210 SEMIFLUIDO CON FIBRA ECOPACT	97.4	0.172	518	5.53e-05	1.28	0.0034	8120
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	97.6	0.173	519	5.54e-05	1.28	0.00341	8150
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	97.4	0.172	518	5.53e-05	1.28	0.0034	8120
210 SEMIFLUIDO 3/8 ECOPACT	102	0.181	559	5.93e-05	1.33	0.00366	8780
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	103	0.184	566	6e-05	1.34	0.00371	8900
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	102	0.181	559	5.93e-05	1.33	0.00366	8780
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	103	0.184	566	6e-05	1.34	0.00371	8900
210 FLUIDO ECOPACT	97.3	0.173	525	5.6e-05	1.28	0.00344	8250
210 FLUIDO CON TEMPERATURA ECOPACT	97.3	0.173	525	5.6e-05	1.28	0.00344	8250
210 FLUIDO CON RETARDANTE ECOPACT	97.5	0.173	526	5.61e-05	1.28	0.00345	8270
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	97.5	0.173	526	5.61e-05	1.28	0.00345	8270
210 FLUIDO CON FIBRA ECOPACT	98.4	0.175	532	5.67e-05	1.29	0.00349	8350
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	98.5	0.175	532	5.67e-05	1.29	0.00349	8370
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	98.5	0.175	532	5.67e-05	1.29	0.00349	8370



210 FLUIDO 3/8 ECOPACT	105	0.187	578	6.11e-05	1.37	0.00379	9060
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	105	0.187	578	6.12e-05	1.37	0.00379	9080
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	105	0.187	578	6.11e-05	1.37	0.00379	9060
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	105	0.187	578	6.12e-05	1.37	0.00379	9080
210 LANZADO ECOPACT	104	0.186	580	6.14e-05	1.36	0.00378	9060
210 LANZADO CON TEMPERATURA ECOPACT	104	0.186	580	6.14e-05	1.36	0.00378	9060
210 PERMEABLE ECOPACT	126	0.217	654	6.82e-05	1.65	0.00432	10200
245 DIRECTO ECOPACT	99.3	0.175	522	5.56e-05	1.31	0.00343	8170
245 BOMBA ECOPACT	99.5	0.176	529	5.63e-05	1.31	0.00347	8280
250 DIRECTO ECOPACT	99.3	0.175	522	5.56e-05	1.31	0.00343	8170
250 BOMBA ECOPACT	99.5	0.176	529	5.63e-05	1.31	0.00347	8280

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NRE	NR R	RR	WD P	LFW	LFHW	CBW C	CWWC	CH W	CNH W
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	8430	258	8170	216	0.00414	0.972	61.9	0.00598	0.105	0.000248	0	6.24
Maximum	11400	354	11000	292	0.0056	12.6	75.2	0.00764	0.205	0.000248	0	6.24
Mean	9220	281	8940	236	0.00451	10.2	65.7	0.00644	0.189	0.000248	0	6.24
Median	9130	278	8810	234	0.00448	9.92	65.4	0.00638	0.189	0.000248	0	6.24
210 DIRECTO ECOPACT	8660	268	8370	222	0.00426	9.14	63.6	0.00614	0.178	0.000248	0	6.24
210 DIRECTO CON TEMPERATURA ECOPACT	8660	266	8330	221	0.00433	9.14	63.6	0.00614	0.178	0.000248	0	6.24



210 DIRECTO CON RETARDANTE ECOPACT	8670	267	8390	221	0.00433	9.14	63.6	0.00615	0.178	0.000248	0	6.24
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	8660	269	8410	221	0.0043	9.14	63.6	0.00615	0.178	0.000248	0	6.24
210 DIRECTO CON FIBRA ECOPACT	8870	277	8590	228	0.00437	8.95	64.5	0.00627	0.189	0.000248	0	6.24
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	8870	274	8640	228	0.0044	8.95	64.6	0.00627	0.189	0.000248	0	6.24
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	8880	274	8590	227	0.00438	8.95	64.5	0.00627	0.189	0.000248	0	6.24
210 BOMBA ECOPACT	8470	261	8250	216	0.0043	9.81	62.1	0.006	0.184	0.000248	0	6.24
210 BOMBA CON TEMPERATURA ECOPACT	8490	261	8200	217	0.00416	9.81	62.1	0.006	0.184	0.000248	0	6.24
210 BOMBA CON RETARDANTE ECOPACT	8520	261	8300	219	0.00417	10.4	62.7	0.00605	0.189	0.000248	0	6.24
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	8540	262	8280	218	0.00417	10.4	62.7	0.00605	0.189	0.000248	0	6.24
210 BOMBA CON FIBRA ECOPACT	8680	267	8410	223	0.00429	9.84	63.3	0.00614	0.189	0.000248	0	6.24



210 BOMBA CON FIBRA Y RETARDANT E ECOPACT	8750	26 4	846 0	225	0.0042 7	10.4	63.9	0.0061 9	0.189	0.0002 48	0	6.24
210 BOMBA CON FRIBRA Y TEMPERATU RA ECOPACT	8700	26 9	845 0	223	0.0042 8	9.84	63.3	0.0061 4	0.189	0.0002 48	0	6.24
210 BOMBA PP ECOPACT	8430	25 9	8170	216	0.0041 4	10.3	61.9	0.0059 8	0.184	0.0002 48	0	6.24
210 BOMBA PP CON TEMPERATU RA ECOPACT	8460	25 8	8190	216	0.0041 5	10.3	61.9	0.0059 8	0.184	0.0002 48	0	6.24
210 SEMIFLUIDO ECOPACT	9070	27 6	877 0	232	0.0044 1	9.9	65.2	0.0063 5	0.189	0.0002 48	0	6.24
210 SEMIFLUIDO CON TEMPERATU RA ECOPACT	909 0	27 6	880 0	233	0.0044 5	9.9	65.2	0.0063 5	0.189	0.0002 48	0	6.24
210 SEMIFLUIDO CON RETARDANT E ECOPACT	9070	27 8	8810	233	0.0044 7	9.9	65.2	0.0063 7	0.189	0.0002 48	0	6.24
210 SEMIFLUIDO CON RETARDANT E Y TEMPERATU RA ECOPACT	9130	27 7	879 0	233	0.0044 5	9.9	65.2	0.0063 7	0.189	0.0002 48	0	6.24
210 SEMIFLUIDO CON FIBRA ECOPACT	9050	27 8	8810	232	0.0044 9	9.92	65.4	0.0063 7	0.2	0.0002 48	0	6.24
210 SEMIFLUIDO CON FIBRA Y RETARDANT E ECOPACT	9070	27 5	8810	234	0.0044 7	9.92	65.4	0.0063 8	0.2	0.0002 48	0	6.24
210 SEMIFLUIDO	9110	28 0	882 0	233	0.0045	9.92	65.4	0.0063 7	0.2	0.0002 48	0	6.24



CON FRIBRA Y TEMPERATURA ECOPACT												
210 SEMIFLUIDO 3/8 ECOPACT	9780	299	9500	250	0.00476	11.6	67.7	0.00674	0.2	0.000248	0	6.24
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	9950	299	9650	255	0.00484	11.6	68.3	0.00682	0.2	0.000248	0	6.24
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	9790	295	9510	251	0.00468	11.6	67.7	0.00674	0.2	0.000248	0	6.24
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	9880	300	9590	255	0.0048	11.6	68.3	0.00682	0.2	0.000248	0	6.24
210 FLUIDO ECOPACT	9190	278	8950	236	0.0045	11.4	65.9	0.00645	0.194	0.000248	0	6.24
210 FLUIDO CON TEMPERATURA ECOPACT	9200	280	8930	236	0.0045	11.4	65.9	0.00645	0.194	0.000248	0	6.24
210 FLUIDO CON RETARDANTE ECOPACT	9230	282	8950	236	0.00449	11.4	65.9	0.00646	0.194	0.000248	0	6.24
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9230	281	8940	236	0.00449	11.4	65.9	0.00646	0.194	0.000248	0	6.24
210 FLUIDO CON FIBRA ECOPACT	9300	282	9030	238	0.00456	11.4	66.5	0.00652	0.194	0.000248	0	6.24
210 FLUIDO CON FIBRA Y	9360	282	9070	239	0.00457	11.3	66.4	0.00652	0.194	0.000248	0	6.24



RETARDANT E ECOPACT												
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9320	281	9030	239	0.00453	11.3	66.4	0.00652	0.194	0.000248	0	6.24
210 FLUIDO 3/8 ECOPACT	10100	303	9830	260	0.00493	11.7	69.3	0.00694	0.205	0.000248	0	6.24
210 FLUIDO 3/8 CON RETARDANT E ECOPACT	10100	308	9850	260	0.00487	11.7	69.4	0.00694	0.205	0.000248	0	6.24
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	10100	302	9880	259	0.00489	11.7	69.3	0.00694	0.205	0.000248	0	6.24
210 FLUIDO 3/8 CON RETARDANT E Y TEMPERATURA ECOPACT	10100	305	9800	260	0.00488	11.7	69.4	0.00694	0.205	0.000248	0	6.24
210 LANZADO ECOPACT	10200	304	9800	260	0.00481	12.6	69.1	0.00695	0.184	0.000248	0	6.24
210 LANZADO CON TEMPERATURA ECOPACT	10200	304	9790	259	0.00486	12.6	69.1	0.00695	0.184	0.000248	0	6.24
210 PERMEABLE ECOPACT	11400	354	11000	292	0.0056	0.972	75.2	0.00764	0.105	0.000248	0	6.24
245 DIRECTO ECOPACT	9130	280	8800	234	0.00448	8.36	65.6	0.0064	0.184	0.000248	0	6.24
245 BOMBA ECOPACT	9270	284	8940	237	0.00453	9.32	66	0.00647	0.189	0.000248	0	6.24
250 DIRECTO ECOPACT	9140	283	8860	234	0.00447	8.36	65.6	0.0064	0.184	0.000248	0	6.24
250 BOMBA ECOPACT	9220	284	8910	237	0.00454	9.32	66	0.00647	0.189	0.000248	0	6.24



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 CO ₂ -Eq	kg CFC-11-Eq	kg NO _x -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	107	0.187	564	5.96e-05	1.4	0.00371	8810
Maximum	131	0.228	705	7.38e-05	1.7	0.00466	11100
Mean	115	0.201	618	6.52e-05	1.5	0.00407	9690
Median	112	0.197	606	6.41e-05	1.47	0.00398	9510
280 DIRECTO ECOPACT	107	0.187	564	5.96e-05	1.4	0.00371	8810
280 DIRECTO CON TEMPERATURA ECOPACT	107	0.187	564	5.96e-05	1.41	0.00371	8820
280 DIRECTO CON RETARDANTE ECOPACT	107	0.187	564	5.96e-05	1.41	0.00371	8820
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	107	0.187	564	5.96e-05	1.41	0.00371	8820
280 DIRECTO CON FIBRA ECOPACT	108	0.189	571	6.03e-05	1.42	0.00375	8910
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	108	0.189	571	6.03e-05	1.42	0.00375	8920
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	108	0.189	571	6.03e-05	1.42	0.00375	8910
280 BOMBA ECOPACT	111	0.195	592	6.26e-05	1.45	0.0039	9300
280 BOMBA CON TEMPERATURA ECOPACT	111	0.195	592	6.26e-05	1.45	0.0039	9300
280 BOMBA CON RETARDANTE ECOPACT	111	0.195	593	6.26e-05	1.45	0.00391	9300
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.195	593	6.26e-05	1.45	0.00391	9300
280 BOMBA CON FIBRA ECOPACT	112	0.197	599	6.32e-05	1.47	0.00395	9400



280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	112	0.197	599	6.32e-05	1.47	0.00395	9400
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	112	0.197	599	6.32e-05	1.47	0.00395	9400
280 BOMBA PP ECOPACT	110	0.194	592	6.26e-05	1.44	0.00389	9280
280 BOMBA PP CON TEMPERATURA ECOPACT	110	0.194	592	6.26e-05	1.44	0.00389	9280
280 SEMIFLUIDO ECOPACT	111	0.195	599	6.34e-05	1.44	0.00394	9400
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	111	0.195	599	6.34e-05	1.44	0.00394	9400
280 SEMIFLUIDO CON RETARDANTE ECOPACT	111	0.195	600	6.35e-05	1.45	0.00394	9420
280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.195	600	6.35e-05	1.45	0.00394	9420
280 SEMIFLUIDO CON FIBRA ECOPACT	112	0.197	606	6.41e-05	1.46	0.00398	9500
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	112	0.197	606	6.41e-05	1.46	0.00399	9520
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	112	0.197	606	6.41e-05	1.46	0.00398	9500
280 SEMIFLUIDO 3/8 ECOPACT	117	0.206	636	6.69e-05	1.53	0.00419	9980
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	118	0.208	643	6.76e-05	1.54	0.00423	10100
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	117	0.206	636	6.69e-05	1.53	0.00419	9980
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	118	0.208	643	6.76e-05	1.54	0.00423	10100
280 FLUIDO ECOPACT	113	0.199	612	6.48e-05	1.47	0.00403	9620



280 FLUIDO CON TEMPERATURA ECOPACT	113	0.199	612	6.48e-05	1.47	0.00403	9620
280 FLUIDO CON RETARDANTE ECOPACT	114	0.201	619	6.55e-05	1.48	0.00407	9730
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	114	0.201	619	6.55e-05	1.48	0.00407	9730
280 FLUIDO CON FIBRA ECOPACT	114	0.2	619	6.54e-05	1.48	0.00407	9710
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	114	0.201	619	6.54e-05	1.48	0.00407	9730
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	114	0.2	619	6.54e-05	1.48	0.00407	9710
280 FLUIDO 3/8 ECOPACT	121	0.213	661	6.94e-05	1.58	0.00435	10400
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	121	0.213	661	6.95e-05	1.58	0.00436	10400
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	121	0.213	661	6.94e-05	1.58	0.00435	10400
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	121	0.213	661	6.95e-05	1.58	0.00436	10400
280 LANZADO ECOPACT	119	0.211	663	7e-05	1.55	0.00433	10300
280 LANZADO CON TEMPERATURA ECOPACT	119	0.21	661	6.95e-05	1.54	0.00432	10300
300 BOMBA ECOPACT	130	0.228	705	7.38e-05	1.7	0.00465	11000
300 BOMBA CON RETARDANTE ECOPACT	131	0.228	705	7.38e-05	1.7	0.00466	11100
300 BOMBA CON TEMPERATURA ECOPACT	130	0.228	705	7.38e-05	1.7	0.00465	11000
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	131	0.228	705	7.38e-05	1.7	0.00466	11100



b) Inventory Metrics:

Indicator/L CI Metric	TPE	RE	NRE	NR R	RR	WD P	LFW	LFHW	CBW C	CWWC	CH W	CNH W
Unit	MJ- Eq	MJ - Eq	MJ- Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	9840	30 1	9510	252	0.0047 8	7.19	68.4	0.0067 9	0.184	0.0002 48	0	6.24
Maximum	1240 0	37 6	1200 0	317	0.0061 2	13.1	80.4	0.0082 7	0.205	0.0002 48	0	6.24
Mean	1080 0	32 8	1050 0	277	0.0052 7	9.06	73.3	0.0073 8	0.198	0.0002 48	0	6.24
Median	1060 0	32 0	1030 0	273	0.0051 4	9.04	72.6	0.0072 8	0.2	0.0002 48	0	6.24
280 DIRECTO ECOPACT	9850	30 2	9510	252	0.0048 4	7.64	68.4	0.0067 9	0.184	0.0002 48	0	6.24
280 DIRECTO CON TEMPERATU RA ECOPACT	9840	30 7	9580	252	0.0048 9	7.64	68.4	0.006 8	0.184	0.0002 48	0	6.24
280 DIRECTO CON RETARDANT E ECOPACT	9870	30 3	9540	252	0.0047 8	7.64	68.4	0.006 8	0.184	0.0002 48	0	6.24
280 DIRECTO CON RETARDANT E Y TEMPERATU RA ECOPACT	9860	30 1	9540	252	0.0048 4	7.64	68.4	0.006 8	0.184	0.0002 48	0	6.24
280 DIRECTO CON FIBRA ECOPACT	9950	30 8	9640	255	0.0049 2	7.65	68.9	0.006 86	0.189	0.0002 48	0	6.24
280 DIRECTO CON FIBRA Y RETARDANT E ECOPACT	9990	30 5	9650	255	0.0049 1	7.65	69	0.006 86	0.189	0.0002 48	0	6.24
280 DIRECTO CON FRIBRA Y TEMPERATU	9970	30 8	9650	255	0.0049 2	7.65	68.9	0.006 86	0.189	0.0002 48	0	6.24



RA ECOPACT												
280 BOMBA ECOPACT	1040 0	31 6	1000 0	266	0.0051 4	8.21	71.1	0.0071	0.2	0.0002 48	0	6.24
280 BOMBA CON TEMPERATU RA ECOPACT	1040 0	31 8	1010 0	266	0.0051 2	8.21	71.1	0.0071	0.2	0.0002 48	0	6.24
280 BOMBA CON RETARDANT E ECOPACT	1040 0	31 6	1010 0	265	0.005 08	8.2	71	0.0071	0.194	0.0002 48	0	6.24
280 BOMBA CON RETARDANT E Y TEMPERATU RA ECOPACT	1040 0	31 7	1010 0	267	0.005 08	8.2	71	0.0071	0.194	0.0002 48	0	6.24
280 BOMBA CON FIBRA ECOPACT	1050 0	321	1020 0	269	0.005 09	8.22	71.6	0.0071 7	0.2	0.0002 48	0	6.24
280 BOMBA CON FIBRA Y RETARDANT E ECOPACT	1050 0	32 0	1020 0	269	0.0051 5	8.22	71.6	0.0071 7	0.2	0.0002 48	0	6.24
280 BOMBA CON FRIBRA Y TEMPERATU RA ECOPACT	1060 0	31 8	1020 0	269	0.0051 4	8.22	71.6	0.0071 7	0.2	0.0002 48	0	6.24
280 BOMBA PP ECOPACT	1040 0	31 3	1000 0	266	0.0049 4	9.06	71.1	0.0071 1	0.2	0.0002 48	0	6.24
280 BOMBA PP CON TEMPERATU RA ECOPACT	1040 0	31 5	1000 0	266	0.0051 4	9.06	71.1	0.0071 1	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO ECOPACT	1050 0	31 6	1020 0	269	0.005 08	10	72.1	0.0072 1	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO CON TEMPERATU RA ECOPACT	1050 0	31 6	1020 0	269	0.005 09	10	72.1	0.0072 1	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO	1050 0	31 7	1020 0	270	0.0051	10	72.1	0.0072 1	0.2	0.0002 48	0	6.24



CON RETARDANT E ECOPACT												
280 SEMIFLUIDO CON RETARDANT E Y TEMPERATU RA ECOPACT	1050 0	31 7	1020 0	268	0.005 07	10	72.1	0.0072 1	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO CON FIBRA ECOPACT	1060 0	32 0	1030 0	272	0.0051 2	10	72.6	0.0072 8	0.205	0.0002 48	0	6.24
280 SEMIFLUIDO CON FIBRA Y RETARDANT E ECOPACT	1070 0	321	1030 0	273	0.0051	10	72.7	0.0072 8	0.205	0.0002 48	0	6.24
280 SEMIFLUIDO CON FRIBRA Y TEMPERATU RA ECOPACT	1060 0	31 9	1030 0	273	0.0051 9	10	72.6	0.0072 8	0.205	0.0002 48	0	6.24
280 SEMIFLUIDO 3/8 ECOPACT	1120 0	33 7	1080 0	286	0.0055 2	9.06	74.5	0.0075 5	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO 3/8 CON RETARDANT E ECOPACT	1130 0	34 1	1090 0	289	0.0054 7	9.07	75.1	0.0076 2	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO 3/8 CON TEMPERATU RA ECOPACT	1110 0	33 8	1080 0	285	0.0053 3	9.06	74.5	0.0075 5	0.2	0.0002 48	0	6.24
280 SEMIFLUIDO 3/8 CON RETARDANT E Y TEMPERATU RA ECOPACT	1130 0	34 0	1100 0	289	0.0055 8	9.07	75.1	0.0076 2	0.2	0.0002 48	0	6.24



280 FLUIDO ECOPACT	1070 0	32 2	1040 0	275	0.0052 2	10.5	73.2	0.0073 5	0.2	0.0002 48	0	6.24
280 FLUIDO CON TEMPERATURA ECOPACT	1070 0	32 0	1040 0	276	0.0051 3	10.5	73.2	0.0073 5	0.2	0.0002 48	0	6.24
280 FLUIDO CON RETARDANTE ECOPACT	1080 0	32 7	1050 0	278	0.0053	10.5	73.8	0.0074 2	0.2	0.0002 48	0	6.24
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	1090 0	32 7	1050 0	279	0.0052 8	10.5	73.8	0.0074 2	0.2	0.0002 48	0	6.24
280 FLUIDO CON FIBRA ECOPACT	1090 0	32 7	1050 0	278	0.0051 6	10.5	73.7	0.0074 1	0.205	0.0002 48	0	6.24
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	1090 0	32 8	1060 0	279	0.0053 1	10.5	73.8	0.0074 2	0.205	0.0002 48	0	6.24
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	1090 0	32 9	1050 0	278	0.0052 4	10.5	73.7	0.0074 1	0.205	0.0002 48	0	6.24
280 FLUIDO 3/8 ECOPACT	1160 0	35 1	1120 0	296	0.005 63	9.02	76.5	0.0078	0.2	0.0002 48	0	6.24
280 FLUIDO 3/8 CON RETARDANTE ECOPACT	1160 0	34 9	1130 0	297	0.0057 4	9.02	76.6	0.0078 1	0.2	0.0002 48	0	6.24
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	1160 0	35 1	1130 0	296	0.0055 2	9.02	76.5	0.0078	0.2	0.0002 48	0	6.24
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	1160 0	34 9	1130 0	298	0.005 6	9.02	76.6	0.0078 1	0.2	0.0002 48	0	6.24



280 LANZADO ECOPACT	11500	345	11200	296	0.00553	13.1	77.5	0.0079	0.2	0.000248	0	6.24
280 LANZADO CON TEMPERATURA ECOPACT	11500	345	11200	295	0.00554	11.8	76.4	0.00781	0.2	0.000248	0	6.24
300 BOMBA ECOPACT	12300	373	12000	316	0.006	7.19	80.4	0.00826	0.2	0.000248	0	6.24
300 BOMBA CON RETARDANTE ECOPACT	12400	375	12000	317	0.00591	7.19	80.4	0.00827	0.2	0.000248	0	6.24
300 BOMBA CON TEMPERATURA ECOPACT	12300	375	12000	316	0.00612	7.19	80.4	0.00826	0.2	0.000248	0	6.24
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12400	376	12000	317	0.00601	7.19	80.4	0.00827	0.2	0.000248	0	6.24

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 CO ₂ -Eq	kg CFC-11-Eq	kg NO _x -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	127	0.222	687	7.2e-05	1.65	0.00453	10800
Maximum	135	0.235	732	7.66e-05	1.75	0.00483	11500
Mean	131	0.229	712	7.46e-05	1.71	0.0047	11200
Median	132	0.231	718	7.52e-05	1.72	0.00473	11300
350 BOMBA ECOPACT	132	0.231	718	7.51e-05	1.72	0.00473	11300
350 BOMBA CON RETARDANTE ECOPACT	132	0.231	718	7.52e-05	1.72	0.00474	11300
350 BOMBA CON TEMPERATURA ECOPACT	132	0.231	718	7.51e-05	1.72	0.00473	11300



350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	132	0.231	718	7.52e-05	1.72	0.00474	11300
350 SEMIFLUIDO ECOPACT	127	0.222	687	7.2e-05	1.65	0.00453	10800
350 SEMIFLUIDO CON RETARDANTE ECOPACT	127	0.222	687	7.21e-05	1.65	0.00454	10800
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	127	0.222	687	7.2e-05	1.65	0.00453	10800
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	127	0.222	687	7.2e-05	1.65	0.00454	10800
350 FLUIDO ECOPACT	134	0.235	731	7.65e-05	1.75	0.00483	11500
350 FLUIDO CON RETARDANTE ECOPACT	135	0.235	732	7.66e-05	1.75	0.00483	11500
350 FLUIDO CON TEMPERATURA ECOPACT	134	0.235	731	7.65e-05	1.75	0.00483	11500
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	135	0.235	732	7.66e-05	1.75	0.00483	11500

b) Inventory Metrics:

Indicator/L CI Metric	TPE	RE	NRE	NR R	RR	WD P	LFW	LFHW	CBW C	CWWC	CH W	CNH W
Unit	MJ-Eq	MJ-Eq	MJ-Eq	kg	m3	m3	kg waste	kg waste	m3	m3	kg	kg
Minimum	12000	364	11700	308	0.00578	7.72	79	0.00809	0.2	0.000248	0	6.24
Maximum	12900	388	12500	330	0.00632	7.9	82.9	0.00856	0.205	0.000248	0	6.24
Mean	12500	378	12100	320	0.00606	7.8	81.2	0.00835	0.203	0.000248	0	6.24
Median	12600	381	12200	323	0.00607	7.83	81.6	0.00842	0.205	0.000248	0	6.24
350 BOMBA ECOPACT	12600	380	12200	323	0.00613	7.72	81.6	0.00841	0.2	0.000248	0	6.24
350 BOMBA CON RETARDANTE ECOPACT	12600	382	12300	323	0.00606	7.72	81.7	0.00842	0.2	0.000248	0	6.24
350 BOMBA CON	12600	380	12200	323	0.00608	7.72	81.6	0.00841	0.2	0.000248	0	6.24



TEMPERATURA ECOPACT												
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12600	383	12300	323	0.00599	7.72	81.7	0.00842	0.2	0.000248	0	6.24
350 SEMIFLUIDO ECOPACT	12000	364	11700	309	0.00585	7.9	79.1	0.00809	0.205	0.000248	0	6.24
350 SEMIFLUIDO CON RETARDANTE ECOPACT	12100	368	11700	309	0.00578	7.86	79.1	0.00809	0.205	0.000248	0	6.24
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	12000	364	11700	308	0.00593	7.86	79	0.00809	0.205	0.000248	0	6.24
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12000	365	11700	309	0.0059	7.77	79	0.00809	0.205	0.000248	0	6.24
350 FLUIDO ECOPACT	12800	384	12400	328	0.00624	7.83	82.8	0.00855	0.205	0.000248	0	6.24
350 FLUIDO CON RETARDANTE ECOPACT	12800	388	12500	329	0.00632	7.83	82.9	0.00856	0.205	0.000248	0	6.24
350 FLUIDO CON TEMPERATURA ECOPACT	12800	386	12500	329	0.00628	7.83	82.8	0.00855	0.205	0.000248	0	6.24
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12900	387	12500	330	0.00618	7.83	82.9	0.00856	0.205	0.000248	0	6.24



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 CO ₂ -Eq	kg CFC-11-Eq	kg NO _x -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	126	0.221	681	7.15e-05	1.64	0.00449	10700
Maximum	129	0.226	700	7.34e-05	1.68	0.00463	11000
Mean	128	0.224	694	7.27e-05	1.67	0.00458	10900
Median	129	0.226	700	7.33e-05	1.68	0.00462	11000
420 BOMBA ECOPACT	126	0.221	681	7.15e-05	1.64	0.00449	10700
420 BOMBA CON RETARDANTE ECOPACT	126	0.221	681	7.15e-05	1.64	0.0045	10700
420 BOMBA CON TEMPERATURA ECOPACT	126	0.221	681	7.15e-05	1.64	0.00449	10700
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	126	0.221	681	7.15e-05	1.64	0.00449	10700
420 SEMIFLUIDO ECOPACT	129	0.226	700	7.33e-05	1.68	0.00462	11000
420 SEMIFLUIDO CON RETARDANTE ECOPACT	129	0.226	700	7.34e-05	1.68	0.00462	11000
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	129	0.226	700	7.33e-05	1.68	0.00462	11000
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	129	0.226	700	7.34e-05	1.68	0.00462	11000
420 FLUIDO ECOPACT	129	0.226	700	7.33e-05	1.68	0.00462	11000
420 FLUIDO CON RETARDANTE ECOPACT	129	0.226	700	7.34e-05	1.68	0.00463	11000
420 FLUIDO CON TEMPERATURA ECOPACT	129	0.226	700	7.33e-05	1.68	0.00462	11000
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	129	0.226	700	7.34e-05	1.68	0.00463	11000



b) Inventory Metrics:

Indicator/L CI Metric	TPE	RE	NRE	NR R	RR	WD P	LFW	LFHW	CBW C	CWWC	CH W	CNH W
Unit	MJ- Eq	MJ - Eq	MJ- Eq	kg	m3	m3	kg wast e	kg waste	m3	m3	kg	kg
Minimum	1200 0	35 9	1150 0	306	0.0057 7	7.91	78.7	0.008 04	0.2	0.0002 48	0	6.24
Maximum	1230 0	371	1190 0	316	0.006 08	7.98	80.3	0.0082 4	0.2	0.0002 48	0	6.24
Mean	1220 0	36 7	1180 0	312	0.0059 2	7.93	79.7	0.0081 7	0.2	0.0002 48	0	6.24
Median	1230 0	36 9	1190 0	314	0.0059 3	7.91	80.2	0.0082 3	0.2	0.0002 48	0	6.24
420 BOMBA ECOPACT	1200 0	36 2	1160 0	307	0.0058 2	7.97	78.7	0.008 04	0.2	0.0002 48	0	6.24
420 BOMBA CON RETARDANT E ECOPACT	1200 0	35 9	1150 0	306	0.0057 7	7.98	78.7	0.008 04	0.2	0.0002 48	0	6.24
420 BOMBA CON TEMPERATU RA ECOPACT	1200 0	35 9	1160 0	306	0.0058 6	7.97	78.7	0.008 04	0.2	0.0002 48	0	6.24
420 BOMBA CON RETARDANT E Y TEMPERATU RA ECOPACT	1200 0	36 0	1160 0	306	0.0057 7	7.97	78.7	0.008 04	0.2	0.0002 48	0	6.24
420 SEMIFLUIDO ECOPACT	1230 0	371	1190 0	316	0.0059 8	7.91	80.2	0.0082 3	0.2	0.0002 48	0	6.24
420 SEMIFLUIDO CON RETARDANT E ECOPACT	1230 0	371	1190 0	316	0.0058 9	7.91	80.2	0.0082 3	0.2	0.0002 48	0	6.24
420 SEMIFLUIDO CON TEMPERATU RA ECOPACT	1230 0	371	1190 0	315	0.0059 6	7.91	80.2	0.0082 3	0.2	0.0002 48	0	6.24
420 SEMIFLUIDO CON RETARDANT E Y	1230 0	36 9	1190 0	314	0.006 08	7.91	80.2	0.0082 3	0.2	0.0002 48	0	6.24



TEMPERATURA ECOPACT												
420 FLUIDO ECOPACT	12300	370	11900	315	0.00595	7.91	80.2	0.00823	0.2	0.000248	0	6.24
420 FLUIDO CON RETARDANTE ECOPACT	12300	370	11900	314	0.00597	7.91	80.3	0.00824	0.2	0.000248	0	6.24
420 FLUIDO CON TEMPERATURA ECOPACT	12300	369	11900	313	0.00604	7.91	80.2	0.00823	0.2	0.000248	0	6.24
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12300	369	11900	315	0.00591	7.91	80.3	0.00824	0.2	0.000248	0	6.24

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>.

