

ENVIRONMENTAL PRODUCT DECLARATION



Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT THEIR APOPA** facility in San Salvador, 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 m ³ 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 <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.csaregistries.ca)
Date of Issue:	09 January 2023
Period of Validity:	5 years; valid until 09 January 2028
EPD Number:	522221ef-d3e3-4ccb-a165-8c90fe0d3d74



TABLE OF CONTENTS

Administrative Information 1

Company Description 3

Study Goal 3

Description Of Product And Scope 3

Ready Mix Concrete Design Summary 4

Ready Mix Concrete Design Composition 14

System Boundaries 15

Cut-Off Criteria 16

Data Sources And Data Quality Assessment 16

 Raw Material Transport..... 16

 Electricity..... 16

 Process/Space Heating..... 16

 Fuel Required For Machinery..... 16

 Waste Generation..... 16

 Recovered Energy..... 17

 Recycled/Reused Material/Components..... 17

 Module A1 Material Losses..... 17

 Direct A3 Emissions Accounting 17

 Waste Transport Requirements..... 17

 Product Transport Requirements..... 17

Data Quality Assessment 18

Environmental Indicators And Inventory Metrics 19

Limitations 20

Total Impact Summary 20

Additional Environmental Info 45

References 46

 Astm Standards..... 46

 Csa Standards 47

 Iso Standards 47

 En Standards 48

 Other References: 48



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 Apopa pan Salvador, El Salvador



This LCA assumes the impacts from products manufactured in accordance with the standards outlined in this report. This LCA is a cradle-to-gate study, and therefore, stages extending beyond the plant gate are not included in this LCA. Excluded stages include transportation of the manufactured material to the construction site; on-site construction processes and components; building (infrastructure) use and maintenance; and "end-of-life" effects.

READY MIX CONCRETE DESIGN SUMMARY

The following tables provide a list of ready mix concrete products considered in this EPD along with key performance parameters.

Mix designs: 0 to 15 MPa:

Table 1: Declared products with Mix designs: 0 to 15MPa considered in this environmental product declaration.

Mix#	Unique name/ID	Short description	Product type	28 day strength, MPa	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
-----	---	---	-----------	----	--------

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:

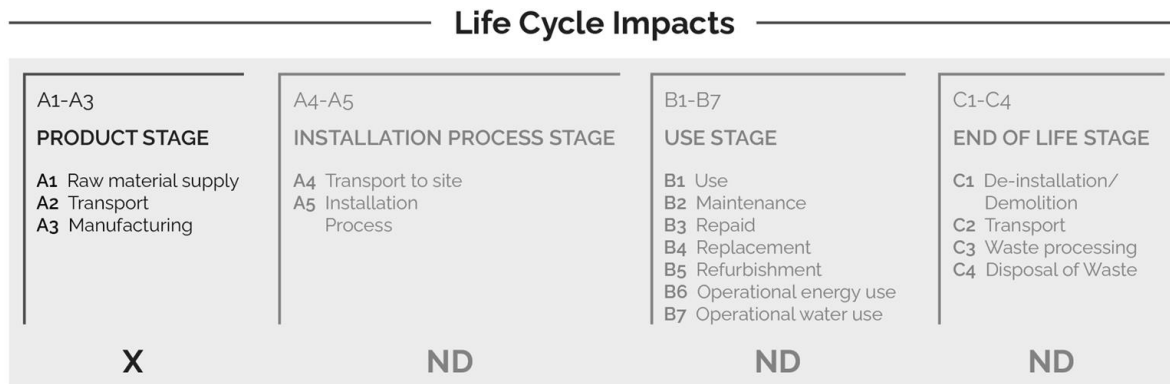


Figure 1: General life cycle phases for consideration in a construction works system.

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.

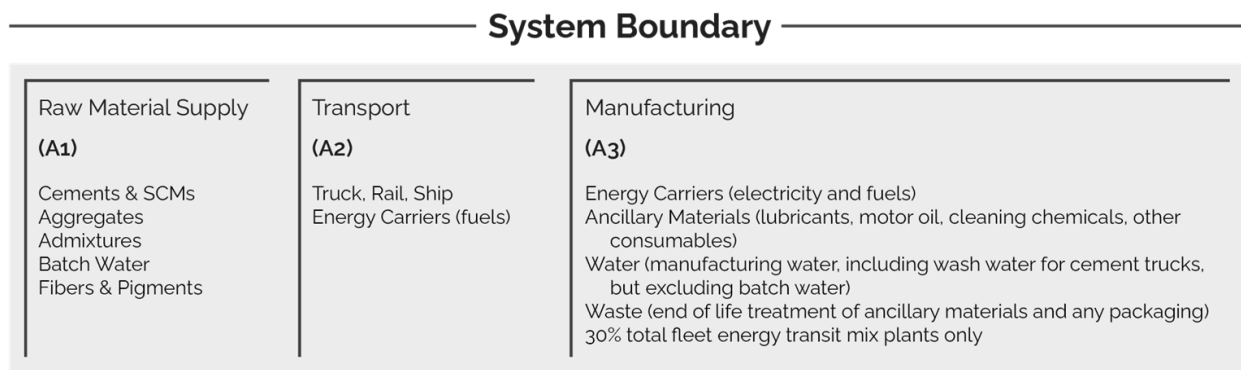


Figure 2: General system inputs considered in the product system and categorized by modules in scope

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 Apopa 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 directly reported from Holcim records. The unit process "market for electricity, medium voltage/electricity, medium voltage/EC/kWh" was used to represent the El Salvador grid electricity used by the concrete plant.

Process/space heating: Not applicable.

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

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



Recovered energy: Not applicable.

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

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

Direct A3 emissions accounting: Not applicable.

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

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

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

Table 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	San Salvador	v3.8 in 2021	2	3	1	3	3
Additives	market for chemical, organic/chemical, organic/GLO/kg	ecoinvent v3.8	Sonsonate	v3.8 in 2021	2	3	1	3	3
Cemento Fuerte Industrial	Cemento Fuerte Industrial	Progam Operator: Labeling Sustainability - EPD ID: ae8c3b6d-1972-4402-	Santa Ana	21 July 2023	3	3	3	3	3



		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	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 CO ₂ -Eq	kg CFC-11-Eq	kg NO _x -Eq	kg Sb-Eq	MJ, net calorific value
Minimum	67.8	0.122	353	3.87e-05	0.917	0.00228	5470
Maximum	77.3	0.137	402	4.37e-05	1.04	0.00263	6290
Mean	72.3	0.129	375	4.1e-05	0.976	0.00244	5850
Median	71.1	0.127	367	4.02e-05	0.964	0.00238	5700
100 BOMBA ECOPACT	67.8	0.122	353	3.87e-05	0.917	0.00228	5470
100 BOMBA CON TEMPERATURA ECOPACT	67.8	0.122	353	3.87e-05	0.917	0.00228	5470
100 BOMBA CON RETARDANTE ECOPACT	67.9	0.122	353	3.88e-05	0.919	0.00229	5490
100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	67.9	0.122	353	3.88e-05	0.919	0.00229	5490
100 BOMBA CON FIBRA ECOPACT	70	0.125	366	4e-05	0.945	0.00237	5670



100 BOMBA CON FIBRA Y RETARDANTE ECOPACT	70.1	0.126	366	4.01e-05	0.946	0.00237	5690
100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	70	0.125	366	4e-05	0.945	0.00237	5670
100 DIRECTO ECOPACT	68.6	0.123	353	3.88e-05	0.931	0.00229	5470
100 DIRECTO CON TEMPERATURA ECOPACT	68.6	0.123	353	3.88e-05	0.931	0.00229	5470
100 DIRECTO CON RETARDANTE ECOPACT	71.1	0.127	367	4.03e-05	0.964	0.00238	5700
100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	71.1	0.127	367	4.03e-05	0.964	0.00238	5700
100 DIRECTO CON FIBRA ECOPACT	71.1	0.127	367	4.02e-05	0.963	0.00237	5680
100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	71.2	0.127	368	4.03e-05	0.965	0.00238	5710
100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	71.1	0.127	367	4.02e-05	0.963	0.00237	5680
140 DIRECTO ECOPACT	76.8	0.136	400	4.35e-05	1.03	0.00262	6270
140 DIRECTO CON RETARDANTE ECOPACT	76.8	0.136	401	4.35e-05	1.03	0.00262	6280
140 DIRECTO CON TEMPERATURA ECOPACT	76.8	0.136	400	4.35e-05	1.03	0.00262	6270
140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	76.8	0.136	401	4.35e-05	1.03	0.00262	6280
140 BOMBA ECOPACT	77.3	0.137	401	4.37e-05	1.04	0.00263	6290
140 BOMBA CON RETARDANTE ECOPACT	77.3	0.137	402	4.37e-05	1.04	0.00263	6290
140 BOMBA CON TEMPERATURA ECOPACT	77.3	0.137	401	4.37e-05	1.04	0.00263	6290
140 BOMBA CON RETARDANTE Y	77.3	0.137	402	4.37e-05	1.04	0.00263	6290



TEMPERATURA ECOPACT												
------------------------	--	--	--	--	--	--	--	--	--	--	--	--

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	609 0	172	592 0	156	0.0028 8	10.6	49.3	0.0046 7	0.178	0.0001 77	0	5.09
Maximum	702 0	20 0	683 0	180	0.0034 3	12	54	0.0052 1	0.189	0.0001 77	0	5.09
Mean	652 0	18 5	634 0	167	0.0031 2	11.4	51.5	0.0049 2	0.185	0.0001 77	0	5.09
Median	636 0	18 2	618 0	163	0.0030 3	11.8	51	0.0048 6	0.184	0.0001 77	0	5.09
100 BOMBA ECOPACT	6110	172	593 0	156	0.0029	12	49.3	0.0046 7	0.184	0.0001 77	0	5.09
100 BOMBA CON TEMPERATU RA ECOPACT	609 0	173	593 0	156	0.0029 3	12	49.3	0.0046 7	0.184	0.0001 77	0	5.09
100 BOMBA CON RETARDANT E ECOPACT	612 0	173	594 0	157	0.0028 8	12	49.3	0.0046 8	0.184	0.0001 77	0	5.09
100 BOMBA CON RETARDANT E Y TEMPERATU RA ECOPACT	610 0	174	595 0	156	0.0029 8	12	49.3	0.0046 8	0.184	0.0001 77	0	5.09
100 BOMBA CON FIBRA ECOPACT	633 0	17 9	616 0	162	0.0029 9	12	50.5	0.0048 1	0.189	0.0001 77	0	5.09
100 BOMBA CON FIBRA Y RETARDANT E ECOPACT	634 0	18 0	617 0	163	0.0029 7	12	50.5	0.0048 2	0.189	0.0001 77	0	5.09
100 BOMBA CON FRIBRA Y TEMPERATU RA ECOPACT	632 0	17 9	612 0	162	0.0030 2	12	50.5	0.0048 1	0.189	0.0001 77	0	5.09
100 DIRECTO ECOPACT	613 0	174	592 0	156	0.0029	11.4	49.5	0.0046 9	0.178	0.0001 77	0	5.09
100 DIRECTO CON TEMPERATU RA ECOPACT	612 0	173	596 0	156	0.0029 7	11.4	49.5	0.0046 9	0.178	0.0001 77	0	5.09



100 DIRECTO CON RETARDANT E ECOPACT	637 0	18 0	619 0	163	0.0030 3	11.8	51	0.0048 6	0.178	0.0001 77	0	5.09
100 DIRECTO CON RETARDANT E Y TEMPERATU RA ECOPACT	637 0	18 2	618 0	163	0.0030 8	11.8	51	0.0048 6	0.178	0.0001 77	0	5.09
100 DIRECTO CON FIBRA ECOPACT	632 0	181	613 0	162	0.0030 3	11.8	51	0.0048 5	0.189	0.0001 77	0	5.09
100 DIRECTO CON FIBRA Y RETARDANT E ECOPACT	638 0	18 2	619 0	163	0.0030 3	11.8	51	0.0048 6	0.184	0.0001 77	0	5.09
100 DIRECTO CON FRIBRA Y TEMPERATU RA ECOPACT	635 0	18 2	615 0	162	0.0030 3	11.8	51	0.0048 5	0.189	0.0001 77	0	5.09
140 DIRECTO ECOPACT	699 0	19 7	680 0	179	0.0033 4	10.6	53.5	0.0051 7	0.184	0.0001 77	0	5.09
140 DIRECTO CON RETARDANT E ECOPACT	700 0	19 7	680 0	180	0.0034 3	10.6	53.5	0.0051 7	0.184	0.0001 77	0	5.09
140 DIRECTO CON TEMPERATU RA ECOPACT	699 0	19 9	680 0	179	0.0034	10.6	53.5	0.0051 7	0.184	0.0001 77	0	5.09
140 DIRECTO CON RETARDANT E Y TEMPERATU RA ECOPACT	702 0	20 0	679 0	179	0.0033 5	10.6	53.5	0.0051 7	0.184	0.0001 77	0	5.09
140 BOMBA ECOPACT	699 0	19 9	682 0	180	0.0033 9	10.8	53.9	0.0052 1	0.189	0.0001 77	0	5.09
140 BOMBA CON RETARDANT E ECOPACT	700 0	19 9	681 0	180	0.0033 6	10.8	54	0.0052 1	0.189	0.0001 77	0	5.09
140 BOMBA CON TEMPERATU RA ECOPACT	702 0	19 8	681 0	179	0.0033 7	10.8	53.9	0.0052 1	0.189	0.0001 77	0	5.09
140 BOMBA CON RETARDANT E Y	702 0	19 9	683 0	179	0.0033 4	10.8	54	0.0052 1	0.189	0.0001 77	0	5.09



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	80.9	0.143	423	4.59e-05	1.08	0.00277	6630
Maximum	83.8	0.148	436	4.72e-05	1.12	0.00287	6850
Mean	82.3	0.146	429	4.65e-05	1.1	0.00282	6740
Median	82.7	0.146	430	4.66e-05	1.11	0.00282	6750
180 BOMBA ECOPACT	80.9	0.143	423	4.59e-05	1.08	0.00277	6630
180 BOMBA CON TEMPERATURA ECOPACT	80.9	0.143	423	4.59e-05	1.08	0.00277	6630
180 BOMBA CON RETARDANTE ECOPACT	81	0.143	423	4.59e-05	1.08	0.00278	6650
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	80.9	0.143	423	4.59e-05	1.08	0.00278	6650
180 BOMBA CON FIBRA ECOPACT	82.9	0.147	435	4.71e-05	1.11	0.00285	6820
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	83	0.147	436	4.71e-05	1.11	0.00286	6840
180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	82.9	0.147	435	4.71e-05	1.11	0.00285	6820
180 DIRECTO ECOPACT	81.5	0.144	423	4.59e-05	1.09	0.00277	6630
180 DIRECTO CON TEMPERATURA ECOPACT	81.5	0.144	423	4.59e-05	1.09	0.00277	6630
180 DIRECTO CON RETARDANTE ECOPACT	82.7	0.146	430	4.66e-05	1.11	0.00282	6750
180 DIRECTO CON RETARDANTE Y	82.7	0.146	430	4.66e-05	1.11	0.00282	6750



TEMPERATURA ECOPACT							
180 DIRECTO CON FIBRA ECOPACT	83.6	0.148	435	4.71e-05	1.12	0.00286	6830
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	83.8	0.148	436	4.72e-05	1.12	0.00287	6850
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	83.6	0.148	435	4.71e-05	1.12	0.00286	6830

b) Inventory Metrics:

Indicator/LCI Metric	TPE	RE	NR E	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	7380	207	7170	189	0.00351	10.2	56.1	0.00544	0.178	0.000177	0	5.09
Maximum	7650	219	7450	196	0.00369	11	57.5	0.0056	0.189	0.000177	0	5.09
Mean	7510	213	7300	192	0.00359	10.5	56.8	0.00552	0.184	0.000177	0	5.09
Median	7540	212	7300	193	0.00358	10.5	56.9	0.00553	0.184	0.000177	0	5.09
180 BOMBA ECOPACT	7410	209	7200	189	0.00359	11	56.4	0.00546	0.184	0.000177	0	5.09
180 BOMBA CON TEMPERATURA ECOPACT	7390	207	7190	189	0.00354	11	56.4	0.00546	0.184	0.000177	0	5.09
180 BOMBA CON RETARDANTE ECOPACT	7420	211	7210	190	0.00351	10.8	56.3	0.00546	0.184	0.000177	0	5.09
180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	7440	211	7210	190	0.00354	10.6	56.1	0.00544	0.184	0.000177	0	5.09
180 BOMBA CON FIBRA ECOPACT	7600	215	7400	195	0.00363	10.6	57.2	0.00557	0.189	0.000177	0	5.09
180 BOMBA CON FIBRA Y RETARDANTE ECOPACT	7610	218	7420	196	0.00359	10.6	57.3	0.00558	0.189	0.000177	0	5.09



180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	7600	214	7340	195	0.00363	10.6	57.2	0.00557	0.189	0.000177	0	5.09
180 DIRECTO ECOPACT	7380	211	7200	189	0.00356	10.4	56.4	0.00546	0.178	0.000177	0	5.09
180 DIRECTO CON TEMPERATURA ECOPACT	7380	210	7170	189	0.00356	10.4	56.4	0.00546	0.178	0.000177	0	5.09
180 DIRECTO CON RETARDANTE ECOPACT	7540	211	7300	193	0.00351	10.2	56.9	0.00553	0.178	0.000177	0	5.09
180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	7540	212	7290	193	0.00361	10.2	56.9	0.00553	0.178	0.000177	0	5.09
180 DIRECTO CON FIBRA ECOPACT	7620	216	7380	195	0.00369	10.3	57.4	0.00559	0.189	0.000177	0	5.09
180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	7650	219	7450	196	0.00368	10.3	57.5	0.0056	0.189	0.000177	0	5.09
180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	7610	219	7400	195	0.00358	10.3	57.4	0.00559	0.189	0.000177	0	5.09

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	0.16	483	5.18e-05	1.21	0.00316	7560
Maximum	126	0.216	653	6.83e-05	1.66	0.00433	10200
Mean	98.4	0.173	526	5.62e-05	1.3	0.00346	8260
Median	97.4	0.171	518	5.55e-05	1.29	0.00342	8150
210 DIRECTO ECOPACT	94.4	0.166	495	5.31e-05	1.26	0.00325	7730



210 DIRECTO CON TEMPERATURA ECOPACT	94.4	0.166	495	5.31e-05	1.26	0.00325	7730
210 DIRECTO CON RETARDANTE ECOPACT	94.6	0.166	496	5.32e-05	1.26	0.00325	7750
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	94.6	0.166	496	5.32e-05	1.26	0.00325	7750
210 DIRECTO CON FIBRA ECOPACT	96.6	0.169	508	5.43e-05	1.28	0.00333	7930
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	96.7	0.169	508	5.44e-05	1.29	0.00334	7950
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	96.6	0.169	508	5.43e-05	1.28	0.00333	7930
210 BOMBA ECOPACT	91.8	0.162	484	5.19e-05	1.22	0.00318	7590
210 BOMBA CON TEMPERATURA ECOPACT	91.8	0.162	484	5.19e-05	1.22	0.00318	7590
210 BOMBA CON RETARDANTE ECOPACT	91.7	0.162	486	5.23e-05	1.22	0.0032	7650
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	91.7	0.162	486	5.23e-05	1.22	0.0032	7650
210 BOMBA CON FIBRA ECOPACT	94	0.165	497	5.32e-05	1.25	0.00326	7790
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	94	0.166	499	5.36e-05	1.25	0.00328	7850
210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	94	0.165	497	5.32e-05	1.25	0.00326	7790
210 BOMBA PP ECOPACT	91	0.16	483	5.18e-05	1.21	0.00316	7560
210 BOMBA PP CON TEMPERATURA ECOPACT	91	0.16	483	5.18e-05	1.21	0.00316	7560
210 SEMIFLUIDO ECOPACT	97.1	0.171	517	5.53e-05	1.29	0.0034	8120
210 SEMIFLUIDO CON TEMPERATURA ECOPACT	97.1	0.171	517	5.53e-05	1.29	0.0034	8120



210 SEMIFLUIDO CON RETARDANTE ECOPACT	97.3	0.171	518	5.54e-05	1.29	0.00341	8150
210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	97.3	0.171	518	5.54e-05	1.29	0.00341	8150
210 SEMIFLUIDO CON FIBRA ECOPACT	97.4	0.171	517	5.54e-05	1.29	0.0034	8130
210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	97.6	0.171	518	5.55e-05	1.29	0.00342	8150
210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	97.4	0.171	517	5.54e-05	1.29	0.0034	8130
210 SEMIFLUIDO 3/8 ECOPACT	102	0.18	558	5.93e-05	1.34	0.00367	8780
210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	103	0.182	565	6.01e-05	1.35	0.00372	8900
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	102	0.18	558	5.93e-05	1.34	0.00367	8780
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	103	0.182	565	6.01e-05	1.35	0.00372	8900
210 FLUIDO ECOPACT	97.3	0.172	524	5.61e-05	1.29	0.00345	8250
210 FLUIDO CON TEMPERATURA ECOPACT	97.3	0.172	524	5.61e-05	1.29	0.00345	8250
210 FLUIDO CON RETARDANTE ECOPACT	97.5	0.172	525	5.62e-05	1.29	0.00345	8270
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	97.5	0.172	525	5.62e-05	1.29	0.00345	8270
210 FLUIDO CON FIBRA ECOPACT	98.4	0.174	531	5.68e-05	1.3	0.00349	8350
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	98.5	0.174	531	5.68e-05	1.3	0.0035	8370
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	98.5	0.174	531	5.68e-05	1.3	0.0035	8370



210 FLUIDO 3/8 ECOPACT	105	0.185	577	6.12e-05	1.38	0.00379	9060
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	105	0.186	577	6.13e-05	1.38	0.0038	9090
210 FLUIDO 3/8 CON TEMPERATURA ECOPACT	105	0.185	577	6.12e-05	1.38	0.00379	9060
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	105	0.186	577	6.13e-05	1.38	0.0038	9090
210 LANZADO ECOPACT	104	0.185	579	6.14e-05	1.37	0.00379	9060
210 LANZADO CON TEMPERATURA ECOPACT	104	0.185	579	6.14e-05	1.37	0.00379	9060
210 PERMEABLE ECOPACT	126	0.216	653	6.83e-05	1.66	0.00433	10200
245 DIRECTO ECOPACT	99.3	0.174	522	5.57e-05	1.32	0.00343	8170
245 BOMBA ECOPACT	99.4	0.174	528	5.64e-05	1.32	0.00347	8280
250 DIRECTO ECOPACT	99.3	0.174	522	5.57e-05	1.32	0.00343	8170
250 BOMBA ECOPACT	99.4	0.174	528	5.64e-05	1.32	0.00347	8280

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	8870	262	8610	227	0.00426	1.01	80.6	0.00709	0.105	0.000189	0	5.03
Maximum	11800	359	11500	303	0.00584	12.6	94.6	0.00875	0.205	0.000189	0	5.03
Mean	9670	285	9380	247	0.00469	10.2	84.7	0.00756	0.189	0.000189	0	5.03
Median	9560	282	9300	245	0.00466	9.92	84.9	0.00756	0.189	0.000189	0	5.03
210 DIRECTO ECOPACT	8650	247	8390	222	0.00417	9.11	62.5	0.0062	0.178	0.000177	0	5.09
210 DIRECTO CON TEMPERATURA ECOPACT	8650	247	8380	221	0.00405	9.11	62.5	0.0062	0.178	0.000177	0	5.09



210 DIRECTO CON RETARDANTE ECOPACT	8620	246	8410	222	0.00414	9.12	62.6	0.00621	0.178	0.000177	0	5.09
210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	8660	251	8430	222	0.00422	9.12	62.6	0.00621	0.178	0.000177	0	5.09
210 DIRECTO CON FIBRA ECOPACT	8850	255	8600	227	0.0043	8.93	63.5	0.00633	0.189	0.000177	0	5.09
210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	8880	256	8630	227	0.0043	8.93	63.5	0.00633	0.189	0.000177	0	5.09
210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	8850	253	8570	227	0.00426	8.93	63.5	0.00633	0.189	0.000177	0	5.09
210 BOMBA ECOPACT	8480	240	8230	217	0.00402	9.79	61.1	0.00606	0.184	0.000177	0	5.09
210 BOMBA CON TEMPERATURA ECOPACT	8470	243	8220	216	0.00405	9.79	61.1	0.00606	0.184	0.000177	0	5.09
210 BOMBA CON RETARDANTE ECOPACT	8520	242	8280	218	0.00406	10.4	61.7	0.00611	0.189	0.000177	0	5.09
210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	8530	241	8280	218	0.00414	10.4	61.7	0.00611	0.189	0.000177	0	5.09
210 BOMBA CON FIBRA ECOPACT	8690	246	8430	223	0.00413	9.81	62.2	0.0062	0.189	0.000177	0	5.09
210 BOMBA CON FIBRA Y RETARDANTE ECOPACT	8760	248	8530	223	0.00416	10.4	62.9	0.00625	0.189	0.000177	0	5.09
210 BOMBA CON FRIBRA	8720	248	8460	223	0.00418	9.81	62.2	0.0062	0.189	0.000177	0	5.09



Y TEMPERATU RA ECOPACT												
210 BOMBA PP ECOPACT	8460	23 8	818 0	216	0.0040 5	10.3	60.8	0.0060 4	0.184	0.0001 77	0	5.09
210 BOMBA PP CON TEMPERATU RA ECOPACT	8450	24 0	8170	216	0.0040 4	10.3	60.8	0.0060 4	0.184	0.0001 77	0	5.09
210 SEMIFLUIDO ECOPACT	9070	25 4	883 0	232	0.0042 9	9.88	64.2	0.0064 2	0.189	0.0001 77	0	5.09
210 SEMIFLUIDO CON TEMPERATU RA ECOPACT	909 0	25 7	882 0	232	0.0043 8	9.88	64.2	0.0064 2	0.189	0.0001 77	0	5.09
210 SEMIFLUIDO CON RETARDANT E ECOPACT	909 0	25 7	883 0	233	0.0043	9.88	64.3	0.0064 3	0.189	0.0001 77	0	5.09
210 SEMIFLUIDO CON RETARDANT E Y TEMPERATU RA ECOPACT	9120	25 6	883 0	233	0.0043 3	9.88	64.3	0.0064 3	0.189	0.0001 77	0	5.09
210 SEMIFLUIDO CON FIBRA ECOPACT	909 0	25 9	882 0	233	0.0042 7	9.89	64.4	0.0064 3	0.2	0.0001 77	0	5.09
210 SEMIFLUIDO CON FIBRA Y RETARDANT E ECOPACT	9110	25 8	887 0	234	0.0043 3	9.89	64.5	0.0064 5	0.2	0.0001 77	0	5.09
210 SEMIFLUIDO CON FRIBRA Y TEMPERATU RA ECOPACT	9070	25 8	883 0	232	0.0043 4	9.89	64.4	0.0064 3	0.2	0.0001 77	0	5.09
210 SEMIFLUIDO 3/8 ECOPACT	9790	27 6	950 0	251	0.0046 3	11.6	66.7	0.0068	0.2	0.0001 77	0	5.09
210 SEMIFLUIDO 3/8 CON	9950	27 8	964 0	254	0.0046 6	11.6	67.3	0.0068 8	0.2	0.0001 77	0	5.09



RETARDANT E ECOPACT												
210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	9790	274	9500	251	0.00462	11.6	66.7	0.0068	0.2	0.000177	0	5.09
210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	9950	277	9640	254	0.00472	11.6	67.3	0.00688	0.2	0.000177	0	5.09
210 FLUIDO ECOPACT	9200	260	8950	236	0.00442	11.4	64.9	0.00651	0.194	0.000177	0	5.09
210 FLUIDO CON TEMPERATURA ECOPACT	9170	260	8950	235	0.00436	11.4	64.9	0.00651	0.194	0.000177	0	5.09
210 FLUIDO CON RETARDANTE ECOPACT	9230	259	8960	237	0.00441	11.4	65	0.00652	0.194	0.000177	0	5.09
210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	9210	259	8990	236	0.00437	11.4	65	0.00652	0.194	0.000177	0	5.09
210 FLUIDO CON FIBRA ECOPACT	9330	264	9040	238	0.00441	11.4	65.5	0.00658	0.194	0.000177	0	5.09
210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	9320	262	9090	239	0.00445	11.3	65.5	0.00658	0.194	0.000177	0	5.09
210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	9310	265	9050	239	0.00444	11.3	65.5	0.00658	0.194	0.000177	0	5.09
210 FLUIDO 3/8 ECOPACT	10100	285	9810	259	0.00481	11.6	68.3	0.007	0.205	0.000177	0	5.09
210 FLUIDO 3/8 CON RETARDANTE ECOPACT	10100	285	9830	260	0.00473	11.6	68.4	0.00701	0.205	0.000177	0	5.09
210 FLUIDO 3/8 CON	10100	284	9800	259	0.00478	11.6	68.3	0.007	0.205	0.000177	0	5.09



TEMPERATURA ECOPACT												
210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	10200	284	9840	259	0.0048	11.6	68.4	0.00701	0.205	0.000177	0	5.09
210 LANZADO ECOPACT	10100	285	9820	260	0.00485	12.6	68.1	0.00701	0.184	0.000177	0	5.09
210 LANZADO CON TEMPERATURA ECOPACT	10100	286	9850	259	0.00482	12.6	68.1	0.00701	0.184	0.000177	0	5.09
210 PERMEABLE ECOPACT	11400	338	11100	292	0.00559	0.971	74.3	0.0077	0.105	0.000177	0	5.09
245 DIRECTO ECOPACT	9140	262	8790	233	0.00444	8.34	64.6	0.00646	0.184	0.000177	0	5.09
245 BOMBA ECOPACT	9250	262	8950	236	0.00446	9.29	65	0.00653	0.189	0.000177	0	5.09
250 DIRECTO ECOPACT	9090	261	8850	234	0.00434	8.34	64.6	0.00646	0.184	0.000177	0	5.09
250 BOMBA ECOPACT	9290	262	9000	237	0.00442	9.29	65	0.00653	0.189	0.000177	0	5.09

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	107	0.186	563	5.97e-05	1.41	0.00371	8810
Maximum	131	0.227	705	7.4e-05	1.71	0.00466	11100
Mean	115	0.2	617	6.53e-05	1.51	0.00407	9700
Median	112	0.196	606	6.42e-05	1.48	0.00399	9520
280 DIRECTO ECOPACT	107	0.186	563	5.97e-05	1.41	0.00371	8810
280 DIRECTO CON TEMPERATURA ECOPACT	107	0.186	563	5.97e-05	1.41	0.00371	8820



280 DIRECTO CON RETARDANTE ECOPACT	107	0.186	563	5.97e-05	1.41	0.00371	8820
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	107	0.186	563	5.97e-05	1.41	0.00371	8820
280 DIRECTO CON FIBRA ECOPACT	108	0.188	570	6.03e-05	1.43	0.00375	8910
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	108	0.188	570	6.04e-05	1.43	0.00375	8920
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	108	0.188	570	6.03e-05	1.43	0.00375	8910
280 BOMBA ECOPACT	111	0.194	592	6.26e-05	1.46	0.00391	9300
280 BOMBA CON TEMPERATURA ECOPACT	111	0.194	592	6.26e-05	1.46	0.00391	9300
280 BOMBA CON RETARDANTE ECOPACT	111	0.194	592	6.27e-05	1.46	0.00391	9300
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.194	592	6.27e-05	1.46	0.00391	9300
280 BOMBA CON FIBRA ECOPACT	112	0.195	598	6.33e-05	1.48	0.00395	9400
280 BOMBA CON FIBRA Y RETARDANTE ECOPACT	112	0.196	598	6.33e-05	1.48	0.00395	9400
280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT	112	0.195	598	6.33e-05	1.48	0.00395	9400
280 BOMBA PP ECOPACT	110	0.193	591	6.27e-05	1.45	0.0039	9290
280 BOMBA PP CON TEMPERATURA ECOPACT	110	0.193	591	6.27e-05	1.45	0.0039	9290
280 SEMIFLUIDO ECOPACT	111	0.194	598	6.35e-05	1.45	0.00394	9410
280 SEMIFLUIDO CON TEMPERATURA ECOPACT	111	0.194	598	6.35e-05	1.45	0.00394	9410
280 SEMIFLUIDO CON RETARDANTE ECOPACT	111	0.194	599	6.36e-05	1.46	0.00395	9420



280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	111	0.194	599	6.36e-05	1.46	0.00395	9420
280 SEMIFLUIDO CON FIBRA ECOPACT	112	0.196	605	6.42e-05	1.47	0.00399	9510
280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT	112	0.196	606	6.42e-05	1.47	0.00399	9520
280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	112	0.196	605	6.42e-05	1.47	0.00399	9510
280 SEMIFLUIDO 3/8 ECOPACT	117	0.205	635	6.7e-05	1.54	0.00419	9980
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	118	0.207	642	6.77e-05	1.55	0.00424	10100
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	117	0.205	635	6.7e-05	1.54	0.00419	9980
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	118	0.207	642	6.77e-05	1.55	0.00424	10100
280 FLUIDO ECOPACT	113	0.197	612	6.49e-05	1.48	0.00403	9620
280 FLUIDO CON TEMPERATURA ECOPACT	113	0.197	612	6.49e-05	1.48	0.00403	9620
280 FLUIDO CON RETARDANTE ECOPACT	114	0.2	618	6.56e-05	1.49	0.00408	9740
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	114	0.2	618	6.56e-05	1.49	0.00408	9740
280 FLUIDO CON FIBRA ECOPACT	114	0.199	618	6.55e-05	1.49	0.00407	9720
280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT	114	0.199	619	6.56e-05	1.49	0.00408	9740
280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT	114	0.199	618	6.55e-05	1.49	0.00407	9720
280 FLUIDO 3/8 ECOPACT	121	0.212	660	6.95e-05	1.59	0.00435	10400



280 FLUIDO 3/8 CON RETARDANTE ECOPACT	121	0.212	660	6.96e-05	1.59	0.00436	10400
280 FLUIDO 3/8 CON TEMPERATURA ECOPACT	121	0.212	660	6.95e-05	1.59	0.00435	10400
280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	121	0.212	660	6.96e-05	1.59	0.00436	10400
280 LANZADO ECOPACT	119	0.21	663	7.01e-05	1.56	0.00433	10300
280 LANZADO CON TEMPERATURA ECOPACT	119	0.209	660	6.97e-05	1.55	0.00432	10300
300 BOMBA ECOPACT	130	0.227	704	7.39e-05	1.71	0.00465	11100
300 BOMBA CON RETARDANTE ECOPACT	131	0.227	705	7.4e-05	1.71	0.00466	11100
300 BOMBA CON TEMPERATURA ECOPACT	130	0.227	704	7.39e-05	1.71	0.00465	11100
300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	131	0.227	705	7.4e-05	1.71	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 wast e	kg waste	m3	m3	kg	kg
Minimum	9820	28 1	9550	252	0.0046 7	7.17	67.3	0.006 85	0.184	0.0001 77	0	5.09
Maximum	1240 0	35 9	1200 0	317	0.0059 2	13.1	79.7	0.0083 4	0.205	0.0001 77	0	5.09
Mean	1080 0	30 8	1050 0	277	0.0051 5	9.04	72.4	0.0074 5	0.198	0.0001 77	0	5.09
Median	1060 0	30 2	1030 0	272	0.0050 5	9.02	71.8	0.0073 5	0.2	0.0001 77	0	5.09
280 DIRECTO ECOPACT	9820	28 3	9550	252	0.0046 7	7.62	67.3	0.006 85	0.184	0.0001 77	0	5.09
280 DIRECTO CON TEMPERATU RA ECOPACT	9840	28 3	9550	252	0.0048 2	7.62	67.3	0.006 85	0.184	0.0001 77	0	5.09



280 DIRECTO CON RETARDANTE ECOPACT	9870	281	9580	252	0.00474	7.62	67.3	0.00685	0.184	0.000177	0	5.09
280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT	9910	283	9600	253	0.00468	7.62	67.3	0.00685	0.184	0.000177	0	5.09
280 DIRECTO CON FIBRA ECOPACT	9950	288	9680	254	0.00483	7.64	67.9	0.00692	0.189	0.000177	0	5.09
280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT	9970	286	9650	256	0.00476	7.64	67.9	0.00692	0.189	0.000177	0	5.09
280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT	9930	285	9630	255	0.00477	7.64	67.9	0.00692	0.189	0.000177	0	5.09
280 BOMBA ECOPACT	10400	295	10100	267	0.00498	8.19	70.1	0.00717	0.2	0.000177	0	5.09
280 BOMBA CON TEMPERATURA ECOPACT	10400	297	10100	266	0.00494	8.19	70.1	0.00717	0.2	0.000177	0	5.09
280 BOMBA CON RETARDANTE ECOPACT	10300	299	10100	266	0.00493	8.18	70.1	0.00717	0.194	0.000177	0	5.09
280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	10400	298	10100	266	0.00501	8.18	70.1	0.00717	0.194	0.000177	0	5.09
280 BOMBA CON FIBRA ECOPACT	10500	302	10200	269	0.00497	8.2	70.7	0.00724	0.2	0.000177	0	5.09



280 BOMBA CON FIBRA Y RETARDANT E ECOPACT	1050 0	30 0	1020 0	269	0.0049 9	8.2	70.7	0.0072 4	0.2	0.0001 77	0	5.09
280 BOMBA CON FRIBRA Y TEMPERATU RA ECOPACT	1050 0	29 9	1020 0	269	0.0050 1	8.2	70.7	0.0072 4	0.2	0.0001 77	0	5.09
280 BOMBA PP ECOPACT	1040 0	29 3	1000 0	266	0.0049 6	9.04	70.2	0.0071 7	0.2	0.0001 77	0	5.09
280 BOMBA PP CON TEMPERATU RA ECOPACT	1040 0	29 6	1010 0	266	0.0049 8	9.04	70.2	0.0071 7	0.2	0.0001 77	0	5.09
280 SEMIFLUIDO ECOPACT	1050 0	29 9	1020 0	269	0.0050 2	9.99	71.2	0.0072 8	0.2	0.0001 77	0	5.09
280 SEMIFLUIDO CON TEMPERATU RA ECOPACT	1050 0	29 7	1020 0	269	0.0049 8	9.99	71.2	0.0072 8	0.2	0.0001 77	0	5.09
280 SEMIFLUIDO CON RETARDANT E ECOPACT	1050 0	29 9	1020 0	269	0.0049 6	9.99	71.3	0.0072 8	0.2	0.0001 77	0	5.09
280 SEMIFLUIDO CON RETARDANT E Y TEMPERATU RA ECOPACT	1050 0	29 8	1020 0	270	0.0049 1	9.99	71.3	0.0072 8	0.2	0.0001 77	0	5.09
280 SEMIFLUIDO CON FIBRA ECOPACT	1060 0	30 1	1030 0	272	0.0050 6	10	71.8	0.0073 5	0.205	0.0001 77	0	5.09
280 SEMIFLUIDO CON FIBRA Y RETARDANT E ECOPACT	1060 0	30 1	1030 0	272	0.0051 1	10	71.8	0.0073 5	0.205	0.0001 77	0	5.09
280 SEMIFLUIDO	1070 0	30 2	1030 0	272	0.0051 2	10	71.8	0.0073 5	0.205	0.0001 77	0	5.09



CON FRIBRA Y TEMPERATURA ECOPACT												
280 SEMIFLUIDO 3/8 ECOPACT	11100	318	10800	286	0.00525	9.04	73.7	0.00762	0.2	0.000177	0	5.09
280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT	11300	318	11000	289	0.00534	9.05	74.3	0.00769	0.2	0.000177	0	5.09
280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT	11100	318	10800	285	0.0052	9.04	73.7	0.00762	0.2	0.000177	0	5.09
280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT	11300	322	10900	288	0.00535	9.05	74.3	0.00769	0.2	0.000177	0	5.09
280 FLUIDO ECOPACT	10700	305	10400	275	0.00504	10.4	72.4	0.00742	0.2	0.000177	0	5.09
280 FLUIDO CON TEMPERATURA ECOPACT	10700	302	10500	275	0.005	10.4	72.4	0.00742	0.2	0.000177	0	5.09
280 FLUIDO CON RETARDANTE ECOPACT	10800	306	10500	279	0.00513	10.4	73	0.0075	0.2	0.000177	0	5.09
280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	10800	309	10500	279	0.00514	10.4	73	0.0075	0.2	0.000177	0	5.09
280 FLUIDO CON FIBRA ECOPACT	10800	307	10600	277	0.00517	10.5	72.9	0.00748	0.205	0.000177	0	5.09
280 FLUIDO CON FIBRA Y	10900	309	10600	278	0.00515	10.5	73	0.00749	0.205	0.000177	0	5.09



RETARDANT E ECOPACT												
280 FLUIDO CON FRIBRA Y TEMPERATU RA ECOPACT	1080 0	30 5	1050 0	278	0.0051 4	10.5	72.9	0.0074 8	0.205	0.0001 77	0	5.09
280 FLUIDO 3/8 ECOPACT	1160 0	33 2	1130 0	296	0.0055 6	9	75.7	0.0078 7	0.2	0.0001 77	0	5.09
280 FLUIDO 3/8 CON RETARDANT E ECOPACT	1160 0	331	1130 0	297	0.0054 7	9	75.8	0.0078 8	0.2	0.0001 77	0	5.09
280 FLUIDO 3/8 CON TEMPERATU RA ECOPACT	1160 0	32 7	1120 0	297	0.0055 8	9	75.7	0.0078 7	0.2	0.0001 77	0	5.09
280 FLUIDO 3/8 CON RETARDANT E Y TEMPERATU RA ECOPACT	1160 0	32 6	1130 0	297	0.0055 6	9	75.8	0.0078 8	0.2	0.0001 77	0	5.09
280 LANZADO ECOPACT	1150 0	32 7	1120 0	296	0.0053 5	13.1	76.7	0.0079 7	0.2	0.0001 77	0	5.09
280 LANZADO CON TEMPERATU RA ECOPACT	1150 0	32 5	1120 0	295	0.0054 5	11.8	75.6	0.0078 8	0.2	0.0001 77	0	5.09
300 BOMBA ECOPACT	1240 0	35 2	1200 0	317	0.0059 2	7.17	79.6	0.0083 3	0.2	0.0001 77	0	5.09
300 BOMBA CON RETARDANT E ECOPACT	1240 0	35 5	1200 0	317	0.0058 9	7.17	79.7	0.0083 4	0.2	0.0001 77	0	5.09
300 BOMBA CON TEMPERATU RA ECOPACT	1230 0	35 4	1200 0	317	0.0058 2	7.17	79.6	0.0083 3	0.2	0.0001 77	0	5.09
300 BOMBA CON RETARDANT E Y TEMPERATU	1230 0	35 9	1200 0	316	0.0059 2	7.17	79.7	0.0083 4	0.2	0.0001 77	0	5.09



RA												
ECOPACT												

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	0.221	686	7.22e-05	1.66	0.00453	10800
Maximum	135	0.234	731	7.67e-05	1.76	0.00484	11500
Mean	131	0.228	712	7.47e-05	1.72	0.00471	11200
Median	132	0.23	718	7.53e-05	1.73	0.00474	11300
350 BOMBA ECOPACT	132	0.23	717	7.52e-05	1.73	0.00474	11300
350 BOMBA CON RETARDANTE ECOPACT	132	0.23	718	7.54e-05	1.73	0.00475	11300
350 BOMBA CON TEMPERATURA ECOPACT	132	0.23	717	7.52e-05	1.73	0.00474	11300
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	132	0.23	718	7.54e-05	1.73	0.00475	11300
350 SEMIFLUIDO ECOPACT	127	0.221	686	7.22e-05	1.66	0.00454	10800
350 SEMIFLUIDO CON RETARDANTE ECOPACT	127	0.221	687	7.22e-05	1.66	0.00454	10800
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	127	0.221	686	7.22e-05	1.66	0.00453	10800
350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	127	0.221	686	7.22e-05	1.66	0.00454	10800
350 FLUIDO ECOPACT	134	0.234	731	7.66e-05	1.76	0.00483	11500
350 FLUIDO CON RETARDANTE ECOPACT	135	0.234	731	7.67e-05	1.76	0.00484	11500
350 FLUIDO CON TEMPERATURA ECOPACT	134	0.234	731	7.66e-05	1.76	0.00483	11500



350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	135	0.234	731	7.67e-05	1.76	0.00484	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	343	11700	307	0.00568	7.7	78.2	0.00816	0.2	0.000177	0	5.09
Maximum	12900	367	12500	329	0.00616	7.88	82.2	0.00863	0.205	0.000177	0	5.09
Mean	12500	357	12100	320	0.00593	7.78	80.5	0.00842	0.203	0.000177	0	5.09
Median	12600	360	12200	322	0.00594	7.81	81	0.00848	0.205	0.000177	0	5.09
350 BOMBA ECOPACT	12600	358	12200	322	0.00598	7.7	80.9	0.00848	0.2	0.000177	0	5.09
350 BOMBA CON RETARDANTE ECOPACT	12600	361	12300	323	0.00609	7.7	81	0.00849	0.2	0.000177	0	5.09
350 BOMBA CON TEMPERATURA ECOPACT	12500	363	12200	322	0.0059	7.7	80.9	0.00848	0.2	0.000177	0	5.09
350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	12600	360	12200	323	0.00589	7.7	81	0.00849	0.2	0.000177	0	5.09
350 SEMIFLUIDO ECOPACT	12100	345	11700	308	0.00568	7.88	78.3	0.00816	0.205	0.000177	0	5.09
350 SEMIFLUIDO CON RETARDANTE ECOPACT	12100	346	11700	308	0.00569	7.84	78.3	0.00816	0.205	0.000177	0	5.09
350 SEMIFLUIDO CON TEMPERATURA ECOPACT	12000	343	11700	307	0.00578	7.84	78.3	0.00816	0.205	0.000177	0	5.09
350 SEMIFLUIDO CON	12100	345	11700	309	0.00579	7.76	78.2	0.00816	0.205	0.000177	0	5.09



RETARDANT E Y TEMPERATURA ECOPACT												
350 FLUIDO ECOPACT	12800	364	12400	328	0.00603	7.81	82.1	0.00863	0.205	0.000177	0	5.09
350 FLUIDO CON RETARDANTE ECOPACT	12900	366	12500	329	0.00609	7.81	82.2	0.00863	0.205	0.000177	0	5.09
350 FLUIDO CON TEMPERATURA ECOPACT	12800	367	12500	329	0.00607	7.81	82.1	0.00863	0.205	0.000177	0	5.09
350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12800	366	12400	329	0.00616	7.81	82.2	0.00863	0.205	0.000177	0	5.09

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	0.219	680	7.16e-05	1.65	0.0045	10700
Maximum	129	0.225	700	7.36e-05	1.69	0.00463	11000
Mean	128	0.223	693	7.29e-05	1.68	0.00458	10900
Median	129	0.225	699	7.35e-05	1.69	0.00462	11000
420 BOMBA ECOPACT	126	0.219	680	7.16e-05	1.65	0.0045	10700
420 BOMBA CON RETARDANTE ECOPACT	126	0.22	681	7.16e-05	1.65	0.0045	10700
420 BOMBA CON TEMPERATURA ECOPACT	126	0.219	680	7.16e-05	1.65	0.0045	10700
420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT	126	0.219	680	7.16e-05	1.65	0.0045	10700
420 SEMIFLUIDO ECOPACT	129	0.225	699	7.35e-05	1.69	0.00462	11000



420 SEMIFLUIDO CON RETARDANTE ECOPACT	129	0.225	699	7.35e-05	1.69	0.00463	11000
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	129	0.225	699	7.35e-05	1.69	0.00462	11000
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	129	0.225	699	7.35e-05	1.69	0.00463	11000
420 FLUIDO ECOPACT	129	0.225	699	7.35e-05	1.69	0.00462	11000
420 FLUIDO CON RETARDANTE ECOPACT	129	0.225	700	7.36e-05	1.69	0.00463	11000
420 FLUIDO CON TEMPERATURA ECOPACT	129	0.225	699	7.35e-05	1.69	0.00462	11000
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	129	0.225	700	7.36e-05	1.69	0.00463	11000

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	11900	339	11600	305	0.00558	7.89	77.9	0.00811	0.2	0.000177	0	5.09
Maximum	12300	353	12000	316	0.00595	7.96	79.5	0.00831	0.2	0.000177	0	5.09
Mean	12200	348	11800	312	0.00579	7.92	79	0.00824	0.2	0.000177	0	5.09
Median	12300	350	11900	314	0.0058	7.9	79.5	0.0083	0.2	0.000177	0	5.09
420 BOMBA ECOPACT	11900	343	11600	306	0.00569	7.96	77.9	0.00811	0.2	0.000177	0	5.09
420 BOMBA CON RETARDANTE ECOPACT	11900	339	11600	307	0.00574	7.96	77.9	0.00811	0.2	0.000177	0	5.09
420 BOMBA CON TEMPERATURA ECOPACT	11900	340	11600	306	0.00568	7.96	77.9	0.00811	0.2	0.000177	0	5.09
420 BOMBA CON RETARDANTE Y	11900	343	11600	305	0.00558	7.96	77.9	0.00811	0.2	0.000177	0	5.09



TEMPERATURA ECOPACT												
420 SEMIFLUIDO ECOPACT	12300	352	11900	314	0.0059	7.89	79.5	0.0083	0.2	0.000177	0	5.09
420 SEMIFLUIDO CON RETARDANTE ECOPACT	12300	352	11900	315	0.00587	7.9	79.5	0.0083	0.2	0.000177	0	5.09
420 SEMIFLUIDO CON TEMPERATURA ECOPACT	12300	348	11900	315	0.00589	7.89	79.5	0.0083	0.2	0.000177	0	5.09
420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12300	350	11900	315	0.00595	7.9	79.5	0.0083	0.2	0.000177	0	5.09
420 FLUIDO ECOPACT	12300	350	12000	316	0.00573	7.89	79.5	0.0083	0.2	0.000177	0	5.09
420 FLUIDO CON RETARDANTE ECOPACT	12300	353	12000	315	0.00588	7.9	79.5	0.00831	0.2	0.000177	0	5.09
420 FLUIDO CON TEMPERATURA ECOPACT	12300	353	11900	314	0.00582	7.89	79.5	0.0083	0.2	0.000177	0	5.09
420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT	12300	351	11900	315	0.00579	7.9	79.5	0.00831	0.2	0.000177	0	5.09

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>.

