

# ENVIRONMENTAL PRODUCT DECLARATION



Environmental Product Declaration for concrete products produced by **HOLCIM EL SALVADOR AT SAN MIGUEL** facility in San Miguel, El Salvador.

## ADMINISTRATIVE INFORMATION

### International Certified Environmental Product Declaration

|   |  |
|---|--|
| <b>Declared Product:</b>                          | This Environmental Product Declaration (EPD) covers concrete products produced by Holcim Nicaragua. Declared unit: 1 m3 of concrete  |
| <b>Declaration Owner:</b>                         | Holcim El Salvador   |
|   | S/N Calle Holcim y Av. El Espino, Madre Selva Antiguo  |
|   | Cuascatlán, El Salvador  |
|   | www.holcim.com.sv  |
| <b>Program Operator:</b>                          | Labeling Sustainability  |
|   | Address, 11670 W Sunset Blvd.  |
|   | City, State, Los Angeles, CA   |
|   | www.labelingsustainability.com   |
| <b>Product Category Rule:</b>                     | 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. |
| <b>Independent LCA Reviewer and EPD Verifier:</b> | 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<br>Geoffrey Guest, Certified 3rd Party Verifier under the International EPD Program ( <a href="http://www.environdec.com">www.environdec.com</a> ), CSA Group ( <a href="http://www.csaregistry.ca">www.csaregistry.ca</a> )  |
| <b>Date of Issue:</b>                             | 06 February 2023   |
| <b>Period of Validity:</b>                        | 5 years; valid until 06 February 2028  |
| <b>EPD Number:</b>                                | 7a6127d1-6261-428f-842f-fc24aa32934a   |



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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 San Miguel, 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 <sub>2</sub> 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 <sub>2</sub> 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 <sub>2</sub> 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<br>CON FIBRA<br>ECOPACT                           | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.5067 |
| 58 | 210 SEMIFLUIDO<br>CON FIBRA Y<br>RETARDANTE<br>ECOPACT           | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.5067 |
| 59 | 210 SEMIFLUIDO<br>CON FRIBRA Y<br>TEMPERATURA<br>ECOPACT         | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.5067 |
| 60 | 210 SEMIFLUIDO 3/8<br>ECOPACT                                    | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4634 |
| 61 | 210 SEMIFLUIDO 3/8<br>CON RETARDANTE<br>ECOPACT                  | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4578 |
| 62 | 210 SEMIFLUIDO 3/8<br>CON TEMPERATURA<br>ECOPACT                 | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4634 |
| 63 | 210 SEMIFLUIDO 3/8<br>CON RETARDANTE<br>Y TEMPERATURA<br>ECOPACT | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4578 |
| 64 | 210 FLUIDO<br>ECOPACT  | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4868 |
| 65 | 210 FLUIDO CON<br>TEMPERATURA<br>ECOPACT                         | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4868 |
| 66 | 210 FLUIDO CON<br>RETARDANTE<br>ECOPACT                          | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4868 |
| 67 | 210 FLUIDO CON<br>RETARDANTE Y<br>TEMPERATURA<br>ECOPACT         | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4868 |
| 68 | 210 FLUIDO CON<br>FIBRA ECOPACT                                  | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4805 |
| 69 | 210 FLUIDO CON<br>FIBRA Y<br>RETARDANTE<br>ECOPACT               | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4805 |
| 70 | 210 FLUIDO CON<br>FRIBRA Y<br>TEMPERATURA<br>ECOPACT             | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4805 |
| 71 | 210 FLUIDO 3/8<br>ECOPACT  | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4588 |
| 72 | 210 FLUIDO 3/8<br>CON RETARDANTE<br>ECOPACT                      | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4588 |



|    |  |  |           |    |        |
|----|--|--|-----------|----|--------|
| 73 | 210 FLUIDO 3/8<br>CON TEMPERATURA<br>ECOPACT                 | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4588 |
| 74 | 210 FLUIDO 3/8<br>CON RETARDANTE<br>Y TEMPERATURA<br>ECOPACT | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4588 |
| 75 | 210 LANZADO<br>ECOPACT                                       | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4070 |
| 76 | 210 LANZADO CON<br>TEMPERATURA<br>ECOPACT                    | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.4070 |
| 77 | 210 PERMEABLE<br>ECOPACT                                     | 21 MPa 28d strength ready<br>mix concrete. | Ready Mix | 21 | 0.2041 |
| 78 | 245 DIRECTO<br>ECOPACT                                       | 24 MPa 28d strength ready<br>mix concrete. | Ready Mix | 24 | 0.4605 |
| 79 | 245 BOMBA<br>ECOPACT   | 24 MPa 28d strength ready<br>mix concrete. | Ready Mix | 24 | 0.4675 |
| 80 | 250 DIRECTO<br>ECOPACT                                       | 25 MPa 28d strength ready<br>mix concrete. | Ready Mix | 25 | 0.4605 |
| 81 | 250 BOMBA<br>ECOPACT   | 25 MPa 28d strength ready<br>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<br>strength,<br>MPa | H <sub>2</sub> O to<br>cement<br>ratio |
|------|---|--|--------------|----------------------------|--|
| 82   | 280 DIRECTO<br>ECOPACT                                    | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix    | 27                         | 0.4217                                 |
| 83   | 280 DIRECTO CON<br>TEMPERATURA<br>ECOPACT                 | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix    | 27                         | 0.4217                                 |
| 84   | 280 DIRECTO CON<br>RETARDANTE<br>ECOPACT                  | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix    | 27                         | 0.4217                                 |
| 85   | 280 DIRECTO CON<br>RETARDANTE Y<br>TEMPERATURA<br>ECOPACT | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix    | 27                         | 0.4217                                 |
| 86   | 280 DIRECTO CON<br>FIBRA ECOPACT                          | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix    | 27                         | 0.4286                                 |
| 87   | 280 DIRECTO CON<br>FIBRA Y<br>RETARDANTE<br>ECOPACT       | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix    | 27                         | 0.4286                                 |
| 88   | 280 DIRECTO CON<br>FRIBRA Y<br>TEMPERATURA<br>ECOPACT     | 27 MPa 28d strength ready<br>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 |



|            |   |  |           |    |        |
|------------|---|--|-----------|----|--------|
| <b>106</b> | 280 SEMIFLUIDO<br>3/8 CON<br>RETARDANTE<br>ECOPACT                  | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4000 |
| <b>107</b> | 280 SEMIFLUIDO<br>3/8 CON<br>TEMPERATURA<br>ECOPACT                 | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4043 |
| <b>108</b> | 280 SEMIFLUIDO<br>3/8 CON<br>RETARDANTE Y<br>TEMPERATURA<br>ECOPACT | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4000 |
| <b>109</b> | 280 FLUIDO<br>ECOPACT   | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4222 |
| <b>110</b> | 280 FLUIDO CON<br>TEMPERATURA<br>ECOPACT                            | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4222 |
| <b>111</b> | 280 FLUIDO CON<br>RETARDANTE<br>ECOPACT                             | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4176 |
| <b>112</b> | 280 FLUIDO CON<br>RETARDANTE Y<br>TEMPERATURA<br>ECOPACT            | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4176 |
| <b>113</b> | 280 FLUIDO CON<br>FIBRA ECOPACT                                     | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4286 |
| <b>114</b> | 280 FLUIDO CON<br>FIBRA Y<br>RETARDANTE<br>ECOPACT                  | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4286 |
| <b>115</b> | 280 FLUIDO CON<br>FRIBRA Y<br>TEMPERATURA<br>ECOPACT                | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.4286 |
| <b>116</b> | 280 FLUIDO 3/8<br>ECOPACT   | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.3878 |
| <b>117</b> | 280 FLUIDO 3/8<br>CON RETARDANTE<br>ECOPACT                         | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.3878 |
| <b>118</b> | 280 FLUIDO 3/8<br>CON TEMPERATURA<br>ECOPACT                        | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.3878 |
| <b>119</b> | 280 FLUIDO 3/8<br>CON RETARDANTE<br>Y TEMPERATURA<br>ECOPACT        | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.3878 |
| <b>120</b> | 280 LANZADO<br>ECOPACT  | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.3838 |
| <b>121</b> | 280 LANZADO CON<br>TEMPERATURA<br>ECOPACT                           | 27 MPa 28d strength ready<br>mix concrete. | Ready Mix | 27 | 0.3838 |



|            |  |   |           |    |        |
|------------|--|---|-----------|----|--------|
| <b>122</b> | 300 BOMBA ECOPACT                              | 29 MPa 28d strength ready mix concrete. | Ready Mix | 29 | 0.3619 |
| <b>123</b> | 300 BOMBA CON RETARDANTE ECOPACT               | 29 MPa 28d strength ready mix concrete. | Ready Mix | 29 | 0.3619 |
| <b>124</b> | 300 BOMBA CON TEMPERATURA ECOPACT              | 29 MPa 28d strength ready mix concrete. | Ready Mix | 29 | 0.3619 |
| <b>125</b> | 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 |
|------------|---|---|--------------|----------------------|---------------------|
| <b>126</b> | 350 BOMBA ECOPACT                                   | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3551              |
| <b>127</b> | 350 BOMBA CON RETARDANTE ECOPACT                    | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3551              |
| <b>128</b> | 350 BOMBA CON TEMPERATURA ECOPACT                   | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3551              |
| <b>129</b> | 350 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT      | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3551              |
| <b>130</b> | 350 SEMIFLUIDO ECOPACT                              | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3824              |
| <b>131</b> | 350 SEMIFLUIDO CON RETARDANTE ECOPACT               | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3824              |
| <b>132</b> | 350 SEMIFLUIDO CON TEMPERATURA ECOPACT              | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3824              |
| <b>133</b> | 350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3824              |
| <b>134</b> | 350 FLUIDO ECOPACT                                  | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3578              |
| <b>135</b> | 350 FLUIDO CON RETARDANTE ECOPACT                   | 34 MPa 28d strength ready mix concrete. | Ready Mix    | 34                   | 0.3578              |
| <b>136</b> | 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 <sub>2</sub> 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:

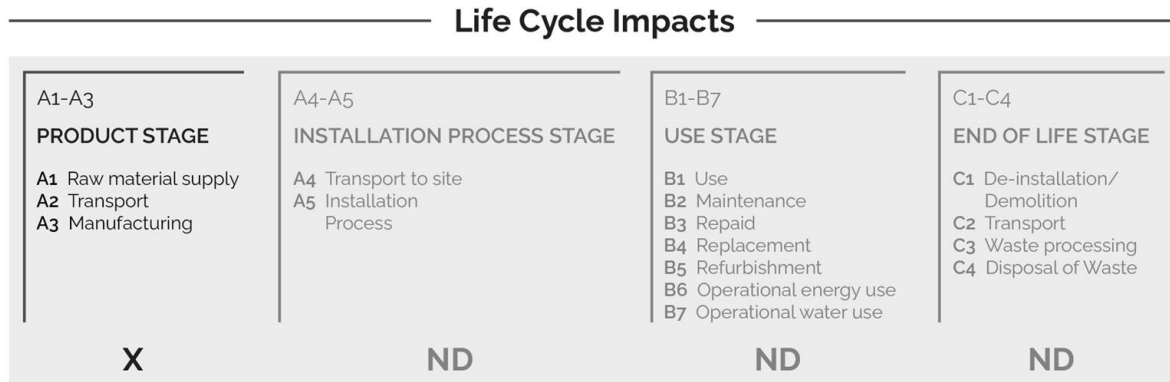


Figure 1: General life cycle phases for consideration in a construction works system.

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.

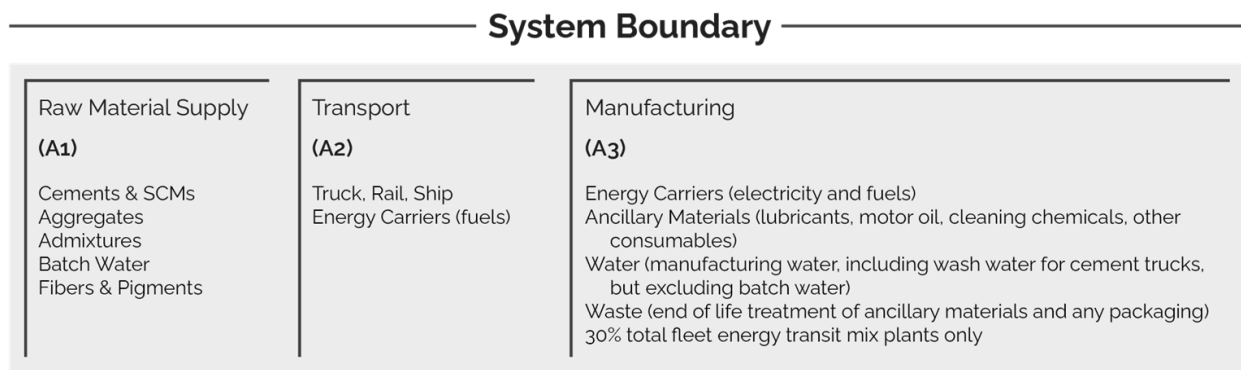


Figure 2: General system inputs considered in the product system and categorized by modules in scope



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 Miguel 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 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 |
|------------------|---|----------------|--------------|--------------|------------|------|-----------|-------------|--------------|
| <b>Fiber</b>     | polypropylene production, granulate/polypropylene, granulate/RoW/kg           | ecoinvent v3.8 | El Salvador  | v3.8 in 2021 | 3          | 3    | 3         | 3           | 3            |
| <b>Water</b>     | tap water production, conventional with biological treatment/tap water/RoW/kg | ecoinvent v3.8 | La Libertaad | v3.8 in 2021 | 2          | 3    | 1         | 3           | 3            |
| <b>Additives</b> | market for chemical, organic/chemical, organic/GLO/kg                         | ecoinvent v3.8 | Sonsonate    | v3.8 in 2021 | 2          | 3    | 1         | 3           | 3            |



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

## DATA QUALITY ASSESSMENT

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

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

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

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



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

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

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

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

## ENVIRONMENTAL INDICATORS AND INVENTORY METRICS

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

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





## LIMITATIONS

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

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

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

## TOTAL IMPACT SUMMARY

The following table reports the total LCA results for each product produced at the given ready mix concrete facility on a per 1m<sup>3</sup> 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 m<sup>3</sup> of concrete basis.**

a) Midpoint Impact Categories:

| Indicator/LCI Metric                           | AP                          | EP    | GWP                    | ODP          | PCOP                   | ADPe     | ADPf                    |
|--|-----------------------------|-------|------------------------|--------------|------------------------|----------|-------------------------|
| Unit   | moles of H <sup>+</sup> -Eq | kg N  | kg CO <sub>2</sub> -Eq | kg CFC-11-Eq | kg NO <sub>x</sub> -Eq | kg Sb-Eq | MJ, net calorific value |
| Minimum  | 68.6                        | 0.117 | 360                    | 4.08e-05     | 0.921                  | 0.00233  | 5600                    |
| Maximum  | 78.9                        | 0.135 | 414                    | 4.68e-05     | 1.05                   | 0.0027   | 6510                    |
| Mean   | 73.6                        | 0.126 | 386                    | 4.37e-05     | 0.985                  | 0.0025   | 6030                    |
| Median   | 72.6                        | 0.124 | 378                    | 4.3e-05      | 0.974                  | 0.00244  | 5900                    |
| 100 BOMBA ECOPACT                              | 68.6                        | 0.117 | 360                    | 4.08e-05     | 0.921                  | 0.00233  | 5600                    |
| 100 BOMBA CON TEMPERATURA ECOPACT              | 68.6                        | 0.117 | 360                    | 4.08e-05     | 0.921                  | 0.00233  | 5600                    |
| 100 BOMBA CON RETARDANTE ECOPACT               | 68.7                        | 0.118 | 361                    | 4.08e-05     | 0.923                  | 0.00233  | 5620                    |
| 100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT | 68.7                        | 0.118 | 361                    | 4.08e-05     | 0.923                  | 0.00233  | 5620                    |
| 100 BOMBA CON FIBRA ECOPACT                    | 71                          | 0.121 | 374                    | 4.21e-05     | 0.951                  | 0.00242  | 5840                    |



|  |      |       |     |          |       |         |      |
|--|------|-------|-----|----------|-------|---------|------|
| 100 BOMBA CON FIBRA Y RETARDANTE ECOPACT         | 71.1 | 0.122 | 375 | 4.22e-05 | 0.953 | 0.00243 | 5860 |
| 100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT       | 71   | 0.121 | 374 | 4.21e-05 | 0.951 | 0.00242 | 5840 |
| 100 DIRECTO ECOPACT                              | 70   | 0.12  | 364 | 4.15e-05 | 0.941 | 0.00235 | 5660 |
| 100 DIRECTO CON TEMPERATURA ECOPACT              | 70   | 0.12  | 364 | 4.15e-05 | 0.941 | 0.00235 | 5660 |
| 100 DIRECTO CON RETARDANTE ECOPACT               | 72.5 | 0.124 | 378 | 4.3e-05  | 0.974 | 0.00244 | 5880 |
| 100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT | 72.5 | 0.124 | 378 | 4.3e-05  | 0.974 | 0.00244 | 5880 |
| 100 DIRECTO CON FIBRA ECOPACT                    | 72.6 | 0.124 | 378 | 4.3e-05  | 0.975 | 0.00245 | 5910 |
| 100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT       | 72.7 | 0.124 | 379 | 4.3e-05  | 0.977 | 0.00246 | 5930 |
| 100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT     | 72.6 | 0.124 | 378 | 4.3e-05  | 0.975 | 0.00245 | 5910 |
| 140 DIRECTO ECOPACT                              | 78.3 | 0.134 | 412 | 4.65e-05 | 1.04  | 0.00269 | 6470 |
| 140 DIRECTO CON RETARDANTE ECOPACT               | 78.4 | 0.134 | 413 | 4.65e-05 | 1.04  | 0.0027  | 6480 |
| 140 DIRECTO CON TEMPERATURA ECOPACT              | 78.3 | 0.134 | 412 | 4.65e-05 | 1.04  | 0.00269 | 6470 |
| 140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT | 78.4 | 0.134 | 413 | 4.65e-05 | 1.04  | 0.0027  | 6480 |
| 140 BOMBA ECOPACT                                | 78.9 | 0.135 | 414 | 4.68e-05 | 1.05  | 0.0027  | 6500 |
| 140 BOMBA CON RETARDANTE ECOPACT                 | 78.9 | 0.135 | 414 | 4.68e-05 | 1.05  | 0.0027  | 6510 |
| 140 BOMBA CON TEMPERATURA ECOPACT                | 78.9 | 0.135 | 414 | 4.68e-05 | 1.05  | 0.0027  | 6500 |
| 140 BOMBA CON RETARDANTE Y                       | 78.9 | 0.135 | 414 | 4.68e-05 | 1.05  | 0.0027  | 6510 |



|                     |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|--|--|--|--|--|--|
| TEMPERATURA ECOPACT |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|--|--|--|--|--|--|

b) Inventory Metrics:

| Indicator/LC I Metric                          | TPE   | RE    | NRE   | NR R | RR      | WD P | LFW      | LFHW     | CBW C | CWW C    | CH W | CNH W |
|--|-------|-------|-------|------|---------|------|----------|----------|-------|----------|------|-------|
| Unit   | MJ-Eq | MJ-Eq | MJ-Eq | kg   | m3      | m3   | kg waste | kg waste | m3    | m3       | kg   | kg    |
| Minimum  | 6230  | 175   | 6050  | 160  | 0.00297 | 10.6 | 53.9     | 0.00502  | 0.178 | 8.34e-06 | 0    | 1.33  |
| Maximum  | 7250  | 205   | 7050  | 186  | 0.0035  | 12   | 62.5     | 0.00576  | 0.189 | 8.34e-06 | 0    | 1.33  |
| Mean   | 6730  | 189   | 6530  | 172  | 0.00323 | 11.4 | 58.3     | 0.00539  | 0.185 | 8.34e-06 | 0    | 1.33  |
| Median   | 6580  | 185   | 6380  | 168  | 0.00316 | 11.8 | 58.1     | 0.00534  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA ECOPACT                              | 6240  | 176   | 6050  | 160  | 0.003   | 12   | 53.9     | 0.00502  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA CON TEMPERATURA ECOPACT              | 6230  | 175   | 6060  | 160  | 0.00301 | 12   | 53.9     | 0.00502  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA CON RETARDANTE ECOPACT               | 6270  | 177   | 6090  | 161  | 0.00302 | 12   | 54       | 0.00503  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT | 6280  | 177   | 6060  | 160  | 0.00297 | 12   | 54       | 0.00503  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA CON FIBRA ECOPACT                    | 6500  | 181   | 6330  | 167  | 0.00314 | 12   | 55.5     | 0.00518  | 0.189 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA CON FIBRA Y RETARDANTE ECOPACT       | 6530  | 184   | 6330  | 167  | 0.00309 | 12   | 55.6     | 0.00518  | 0.189 | 8.34e-06 | 0    | 1.33  |
| 100 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT     | 6530  | 184   | 6340  | 167  | 0.00314 | 12   | 55.5     | 0.00518  | 0.189 | 8.34e-06 | 0    | 1.33  |
| 100 DIRECTO ECOPACT                            | 6310  | 179   | 6100  | 162  | 0.00303 | 11.4 | 56.5     | 0.00517  | 0.178 | 8.34e-06 | 0    | 1.33  |
| 100 DIRECTO CON TEMPERATURA ECOPACT            | 6290  | 178   | 6130  | 162  | 0.00305 | 11.4 | 56.5     | 0.00517  | 0.178 | 8.34e-06 | 0    | 1.33  |



|   |      |     |      |     |         |      |      |         |       |          |   |     |
|---|------|-----|------|-----|---------|------|------|---------|-------|----------|---|-----|
| <b>100 DIRECTO CON RETARDANTE ECOPACT</b>               | 6570 | 185 | 6370 | 168 | 0.00321 | 11.8 | 58.1 | 0.00534 | 0.178 | 8.34e-06 | 0 | 133 |
| <b>100 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 6560 | 184 | 6370 | 168 | 0.00314 | 11.8 | 58.1 | 0.00534 | 0.178 | 8.34e-06 | 0 | 133 |
| <b>100 DIRECTO CON FIBRA ECOPACT</b>                    | 6590 | 185 | 6410 | 169 | 0.00318 | 11.8 | 58.1 | 0.00534 | 0.189 | 8.34e-06 | 0 | 133 |
| <b>100 DIRECTO CON FIBRA Y RETARDANTE ECOPACT</b>       | 6610 | 186 | 6410 | 169 | 0.00319 | 11.8 | 58.2 | 0.00535 | 0.184 | 8.34e-06 | 0 | 133 |
| <b>100 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT</b>     | 6600 | 186 | 6380 | 168 | 0.00314 | 11.8 | 58.1 | 0.00534 | 0.189 | 8.34e-06 | 0 | 133 |
| <b>140 DIRECTO ECOPACT</b>                              | 7210 | 202 | 6990 | 184 | 0.00346 | 10.6 | 61.6 | 0.0057  | 0.184 | 8.34e-06 | 0 | 133 |
| <b>140 DIRECTO CON RETARDANTE ECOPACT</b>               | 7230 | 202 | 7030 | 185 | 0.00342 | 10.6 | 61.7 | 0.00571 | 0.184 | 8.34e-06 | 0 | 133 |
| <b>140 DIRECTO CON TEMPERATURA ECOPACT</b>              | 7240 | 204 | 7020 | 186 | 0.00345 | 10.6 | 61.6 | 0.0057  | 0.184 | 8.34e-06 | 0 | 133 |
| <b>140 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 7210 | 203 | 7040 | 185 | 0.0035  | 10.6 | 61.7 | 0.00571 | 0.184 | 8.34e-06 | 0 | 133 |
| <b>140 BOMBA ECOPACT</b>                                | 7240 | 204 | 7030 | 185 | 0.00341 | 10.9 | 62.5 | 0.00576 | 0.189 | 8.34e-06 | 0 | 133 |
| <b>140 BOMBA CON RETARDANTE ECOPACT</b>                 | 7240 | 203 | 7050 | 186 | 0.00349 | 10.9 | 62.5 | 0.00576 | 0.189 | 8.34e-06 | 0 | 133 |
| <b>140 BOMBA CON TEMPERATURA ECOPACT</b>                | 7250 | 204 | 7030 | 185 | 0.00345 | 10.9 | 62.5 | 0.00576 | 0.189 | 8.34e-06 | 0 | 133 |
| <b>140 BOMBA CON RETARDANTE Y</b>                       | 7240 | 205 | 7030 | 186 | 0.0035  | 10.9 | 62.5 | 0.00576 | 0.189 | 8.34e-06 | 0 | 133 |



|                     |  |  |  |  |  |  |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|--|--|--|--|--|
| 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 m<sup>3</sup> of concrete basis.

### a) Midpoint Impact Categories:

| Indicator/LCI Metric                           | AP                          | EP    | GWP                    | ODP          | PCOP                   | ADPe     | ADPf                    |
|--|-----------------------------|-------|------------------------|--------------|------------------------|----------|-------------------------|
| Unit   | moles of H <sup>+</sup> -Eq | kg N  | kg CO <sub>2</sub> -Eq | kg CFC-11-Eq | kg NO <sub>x</sub> -Eq | kg Sb-Eq | MJ, net calorific value |
| Minimum  | 82.3                        | 0.141 | 434                    | 4.88e-05     | 1.09                   | 0.00284  | 6830                    |
| Maximum  | 86                          | 0.146 | 452                    | 5.08e-05     | 1.14                   | 0.00296  | 7130                    |
| Mean   | 84.1                        | 0.143 | 443                    | 4.98e-05     | 1.12                   | 0.0029   | 6980                    |
| Median   | 84.6                        | 0.144 | 444                    | 5.01e-05     | 1.12                   | 0.00291  | 7000                    |
| 180 BOMBA ECOPACT                              | 82.3                        | 0.141 | 434                    | 4.88e-05     | 1.09                   | 0.00284  | 6830                    |
| 180 BOMBA CON TEMPERATURA ECOPACT              | 82.3                        | 0.141 | 434                    | 4.88e-05     | 1.09                   | 0.00284  | 6830                    |
| 180 BOMBA CON RETARDANTE ECOPACT               | 82.4                        | 0.141 | 434                    | 4.88e-05     | 1.1                    | 0.00285  | 6850                    |
| 180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT | 82.3                        | 0.141 | 434                    | 4.88e-05     | 1.09                   | 0.00285  | 6850                    |
| 180 BOMBA CON FIBRA ECOPACT                    | 84.6                        | 0.144 | 448                    | 5.01e-05     | 1.12                   | 0.00293  | 7060                    |
| 180 BOMBA CON FIBRA Y RETARDANTE ECOPACT       | 84.7                        | 0.145 | 448                    | 5.02e-05     | 1.12                   | 0.00294  | 7080                    |
| 180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT     | 84.6                        | 0.144 | 448                    | 5.01e-05     | 1.12                   | 0.00293  | 7060                    |
| 180 DIRECTO ECOPACT                            | 83.4                        | 0.142 | 437                    | 4.94e-05     | 1.11                   | 0.00286  | 6870                    |
| 180 DIRECTO CON TEMPERATURA ECOPACT            | 83.4                        | 0.142 | 437                    | 4.94e-05     | 1.11                   | 0.00286  | 6870                    |
| 180 DIRECTO CON RETARDANTE ECOPACT             | 84.6                        | 0.144 | 444                    | 5.01e-05     | 1.13                   | 0.00291  | 7000                    |
| 180 DIRECTO CON RETARDANTE Y                   | 84.6                        | 0.144 | 444                    | 5.01e-05     | 1.13                   | 0.00291  | 7000                    |



|  |      |       |     |          |      |         |      |
|--|------|-------|-----|----------|------|---------|------|
| TEMPERATURA ECOPACT                          |      |       |     |          |      |         |      |
| 180 DIRECTO CON FIBRA ECOPACT                | 85.8 | 0.146 | 451 | 5.08e-05 | 1.14 | 0.00296 | 7110 |
| 180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT   | 86   | 0.146 | 452 | 5.08e-05 | 1.14 | 0.00296 | 7130 |
| 180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT | 85.8 | 0.146 | 451 | 5.08e-05 | 1.14 | 0.00296 | 7110 |

## b) Inventory Metrics:

| Indicator/LC I Metric                          | TPE   | RE    | NRE   | NR R | RR      | WD P | LFW      | LFHW     | CBW C | CWW C    | CH W | CNH W |
|--|-------|-------|-------|------|---------|------|----------|----------|-------|----------|------|-------|
| Unit   | MJ-Eq | MJ-Eq | MJ-Eq | kg   | m3      | m3   | kg waste | kg waste | m3    | m3       | kg   | kg    |
| Minimum  | 7560  | 212   | 7390  | 195  | 0.00364 | 10.2 | 64.2     | 0.00596  | 0.178 | 8.34e-06 | 0    | 133   |
| Maximum  | 7970  | 223   | 7710  | 204  | 0.00379 | 11   | 67.9     | 0.00625  | 0.189 | 8.34e-06 | 0    | 133   |
| Mean   | 7770  | 218   | 7550  | 199  | 0.00372 | 10.5 | 66       | 0.0061   | 0.184 | 8.34e-06 | 0    | 133   |
| Median   | 7800  | 218   | 7580  | 200  | 0.00372 | 10.5 | 66       | 0.00611  | 0.184 | 8.34e-06 | 0    | 133   |
| 180 BOMBA ECOPACT                              | 7600  | 214   | 7420  | 195  | 0.00367 | 11   | 64.2     | 0.00596  | 0.184 | 8.34e-06 | 0    | 133   |
| 180 BOMBA CON TEMPERATURA ECOPACT              | 7560  | 212   | 7400  | 195  | 0.00364 | 11   | 64.2     | 0.00596  | 0.184 | 8.34e-06 | 0    | 133   |
| 180 BOMBA CON RETARDANTE ECOPACT               | 7610  | 214   | 7410  | 195  | 0.00366 | 10.8 | 64.2     | 0.00597  | 0.184 | 8.34e-06 | 0    | 133   |
| 180 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT | 7610  | 214   | 7390  | 195  | 0.00365 | 10.6 | 64.2     | 0.00596  | 0.184 | 8.34e-06 | 0    | 133   |
| 180 BOMBA CON FIBRA ECOPACT                    | 7850  | 220   | 7660  | 201  | 0.00375 | 10.6 | 65.7     | 0.00611  | 0.189 | 8.34e-06 | 0    | 133   |
| 180 BOMBA CON FIBRA Y RETARDANTE ECOPACT       | 7880  | 221   | 7670  | 202  | 0.00378 | 10.6 | 65.8     | 0.00612  | 0.189 | 8.34e-06 | 0    | 133   |





|  |      |     |      |     |         |      |      |         |       |          |   |     |
|--|------|-----|------|-----|---------|------|------|---------|-------|----------|---|-----|
| 180 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT       | 7860 | 218 | 7630 | 201 | 0.00372 | 10.6 | 65.7 | 0.00611 | 0.189 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO ECOPACT                              | 7670 | 217 | 7470 | 196 | 0.00368 | 10.4 | 66.3 | 0.00609 | 0.178 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO CON TEMPERATURA ECOPACT              | 7660 | 215 | 7410 | 196 | 0.00366 | 10.4 | 66.3 | 0.00609 | 0.178 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO CON RETARDANTE ECOPACT               | 7810 | 219 | 7550 | 200 | 0.00373 | 10.2 | 67.1 | 0.00617 | 0.178 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT | 7800 | 221 | 7600 | 199 | 0.00371 | 10.2 | 67.1 | 0.00617 | 0.178 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO CON FIBRA ECOPACT                    | 7910 | 223 | 7710 | 203 | 0.00379 | 10.3 | 67.8 | 0.00624 | 0.189 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO CON FIBRA Y RETARDANTE ECOPACT       | 7970 | 223 | 7710 | 204 | 0.00379 | 10.3 | 67.9 | 0.00625 | 0.189 | 8.34e-06 | 0 | 133 |
| 180 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT     | 7930 | 222 | 7680 | 202 | 0.00378 | 10.3 | 67.8 | 0.00624 | 0.189 | 8.34e-06 | 0 | 133 |

### 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 <sup>+</sup> -Eq | kg N  | kg CO <sub>2</sub> -Eq | kg CFC-11-Eq | kg NO <sub>x</sub> -Eq | kg Sb-Eq | MJ, net calorific value |
| Minimum              | 93                          | 0.159 | 497                    | 5.55e-05     | 1.23                   | 0.00325  | 7810                    |
| Maximum              | 133                         | 0.227 | 705                    | 7.95e-05     | 1.74                   | 0.00463  | 11000                   |
| Mean                 | 100                         | 0.172 | 542                    | 6e-05        | 1.32                   | 0.00355  | 8530                    |
| Median               | 99.7                        | 0.17  | 535                    | 5.93e-05     | 1.31                   | 0.00351  | 8440                    |
| 210 DIRECTO ECOPACT  | 97.3                        | 0.166 | 516                    | 5.79e-05     | 1.29                   | 0.00337  | 8060                    |



|   |      |       |     |          |      |         |      |
|---|------|-------|-----|----------|------|---------|------|
| <b>210 DIRECTO CON TEMPERATURA ECOPACT</b>              | 97.3 | 0.166 | 516 | 5.79e-05 | 1.29 | 0.00337 | 8060 |
| <b>210 DIRECTO CON RETARDANTE ECOPACT</b>               | 97.4 | 0.166 | 516 | 5.8e-05  | 1.29 | 0.00338 | 8080 |
| <b>210 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 97.4 | 0.166 | 516 | 5.8e-05  | 1.29 | 0.00338 | 8080 |
| <b>210 DIRECTO CON FIBRA ECOPACT</b>                    | 99.7 | 0.17  | 530 | 5.93e-05 | 1.32 | 0.00347 | 8310 |
| <b>210 DIRECTO CON FIBRA Y RETARDANTE ECOPACT</b>       | 99.8 | 0.17  | 530 | 5.94e-05 | 1.32 | 0.00347 | 8320 |
| <b>210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT</b>     | 99.7 | 0.17  | 530 | 5.93e-05 | 1.32 | 0.00347 | 8310 |
| <b>210 BOMBA ECOPACT</b>                                | 94.2 | 0.161 | 501 | 5.61e-05 | 1.25 | 0.00328 | 7880 |
| <b>210 BOMBA CON TEMPERATURA ECOPACT</b>                | 94.2 | 0.161 | 501 | 5.61e-05 | 1.25 | 0.00328 | 7880 |
| <b>210 BOMBA CON RETARDANTE ECOPACT</b>                 | 93.5 | 0.16  | 500 | 5.57e-05 | 1.23 | 0.00328 | 7880 |
| <b>210 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT</b>   | 93.5 | 0.16  | 500 | 5.57e-05 | 1.23 | 0.00328 | 7880 |
| <b>210 BOMBA CON FIBRA ECOPACT</b>                      | 96.7 | 0.165 | 516 | 5.75e-05 | 1.28 | 0.00338 | 8120 |
| <b>210 BOMBA CON FIBRA Y RETARDANTE ECOPACT</b>         | 96   | 0.164 | 514 | 5.71e-05 | 1.26 | 0.00338 | 8120 |
| <b>210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT</b>       | 96.7 | 0.165 | 516 | 5.75e-05 | 1.28 | 0.00338 | 8120 |
| <b>210 BOMBA PP ECOPACT</b>                             | 93   | 0.159 | 497 | 5.55e-05 | 1.23 | 0.00325 | 7810 |
| <b>210 BOMBA PP CON TEMPERATURA ECOPACT</b>             | 93   | 0.159 | 497 | 5.55e-05 | 1.23 | 0.00325 | 7810 |
| <b>210 SEMIFLUIDO ECOPACT</b>                           | 99.2 | 0.17  | 532 | 5.92e-05 | 1.31 | 0.00349 | 8380 |
| <b>210 SEMIFLUIDO CON TEMPERATURA ECOPACT</b>           | 99.2 | 0.17  | 532 | 5.92e-05 | 1.31 | 0.00349 | 8380 |



|  |      |       |     |          |      |         |      |
|--|------|-------|-----|----------|------|---------|------|
| <b>210 SEMIFLUIDO<br/>CON RETARDANTE<br/>ECOPACT</b>                       | 99.4 | 0.17  | 533 | 5.93e-05 | 1.31 | 0.0035  | 8410 |
| <b>210 SEMIFLUIDO<br/>CON RETARDANTE Y<br/>TEMPERATURA<br/>ECOPACT</b>     | 99.4 | 0.17  | 533 | 5.93e-05 | 1.31 | 0.0035  | 8410 |
| <b>210 SEMIFLUIDO<br/>CON FIBRA<br/>ECOPACT</b>                            | 99.8 | 0.17  | 535 | 5.94e-05 | 1.31 | 0.00351 | 8430 |
| <b>210 SEMIFLUIDO<br/>CON FIBRA Y<br/>RETARDANTE<br/>ECOPACT</b>           | 100  | 0.171 | 536 | 5.95e-05 | 1.32 | 0.00352 | 8460 |
| <b>210 SEMIFLUIDO<br/>CON FRIBRA Y<br/>TEMPERATURA<br/>ECOPACT</b>         | 99.8 | 0.17  | 535 | 5.94e-05 | 1.31 | 0.00351 | 8430 |
| <b>210 SEMIFLUIDO 3/8<br/>ECOPACT</b>                                      | 103  | 0.177 | 567 | 6.19e-05 | 1.34 | 0.00372 | 8940 |
| <b>210 SEMIFLUIDO 3/8<br/>CON RETARDANTE<br/>ECOPACT</b>                   | 104  | 0.179 | 574 | 6.26e-05 | 1.36 | 0.00377 | 9060 |
| <b>210 SEMIFLUIDO 3/8<br/>CON TEMPERATURA<br/>ECOPACT</b>                  | 103  | 0.177 | 567 | 6.19e-05 | 1.34 | 0.00372 | 8940 |
| <b>210 SEMIFLUIDO 3/8<br/>CON RETARDANTE Y<br/>TEMPERATURA<br/>ECOPACT</b> | 104  | 0.179 | 574 | 6.26e-05 | 1.36 | 0.00377 | 9060 |
| <b>210 FLUIDO<br/>ECOPACT</b>  | 98.6 | 0.169 | 535 | 5.89e-05 | 1.3  | 0.00351 | 8440 |
| <b>210 FLUIDO CON<br/>TEMPERATURA<br/>ECOPACT</b>                          | 98.6 | 0.169 | 535 | 5.89e-05 | 1.3  | 0.00351 | 8440 |
| <b>210 FLUIDO CON<br/>RETARDANTE<br/>ECOPACT</b>                           | 98.8 | 0.169 | 535 | 5.9e-05  | 1.3  | 0.00352 | 8460 |
| <b>210 FLUIDO CON<br/>RETARDANTE Y<br/>TEMPERATURA<br/>ECOPACT</b>         | 98.8 | 0.169 | 535 | 5.9e-05  | 1.3  | 0.00352 | 8460 |
| <b>210 FLUIDO CON<br/>FIBRA ECOPACT</b>                                    | 100  | 0.171 | 542 | 5.97e-05 | 1.31 | 0.00356 | 8580 |
| <b>210 FLUIDO CON<br/>FIBRA Y<br/>RETARDANTE<br/>ECOPACT</b>               | 100  | 0.171 | 543 | 5.97e-05 | 1.31 | 0.00357 | 8600 |
| <b>210 FLUIDO CON<br/>FRIBRA Y<br/>TEMPERATURA<br/>ECOPACT</b>             | 100  | 0.171 | 543 | 5.97e-05 | 1.31 | 0.00357 | 8600 |



|   |     |       |     |          |      |         |       |
|---|-----|-------|-----|----------|------|---------|-------|
| 210 FLUIDO 3/8 ECOPACT                              | 106 | 0.182 | 586 | 6.38e-05 | 1.38 | 0.00384 | 9230  |
| 210 FLUIDO 3/8 CON RETARDANTE ECOPACT               | 106 | 0.182 | 587 | 6.39e-05 | 1.39 | 0.00385 | 9250  |
| 210 FLUIDO 3/8 CON TEMPERATURA ECOPACT              | 106 | 0.182 | 586 | 6.38e-05 | 1.38 | 0.00384 | 9230  |
| 210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT | 106 | 0.182 | 587 | 6.39e-05 | 1.39 | 0.00385 | 9250  |
| 210 LANZADO ECOPACT                                 | 105 | 0.181 | 586 | 6.35e-05 | 1.37 | 0.00382 | 9190  |
| 210 LANZADO CON TEMPERATURA ECOPACT                 | 105 | 0.181 | 586 | 6.35e-05 | 1.37 | 0.00382 | 9190  |
| 210 PERMEABLE ECOPACT                               | 133 | 0.227 | 705 | 7.95e-05 | 1.74 | 0.00463 | 11000 |
| 245 DIRECTO ECOPACT                                 | 103 | 0.175 | 545 | 6.1e-05  | 1.35 | 0.00357 | 8540  |
| 245 BOMBA ECOPACT                                   | 102 | 0.174 | 547 | 6.09e-05 | 1.34 | 0.00358 | 8590  |
| 250 DIRECTO ECOPACT                                 | 103 | 0.175 | 545 | 6.1e-05  | 1.35 | 0.00357 | 8540  |
| 250 BOMBA ECOPACT                                   | 102 | 0.174 | 547 | 6.09e-05 | 1.34 | 0.00358 | 8590  |

b) Inventory Metrics:

| Indicator/LCI Metric                | TPE   | RE    | NRE   | NR R | RR      | WD P | LFW      | LFHW     | CBW C | CWW C    | CH W | CNH W |
|-------------------------------------|-------|-------|-------|------|---------|------|----------|----------|-------|----------|------|-------|
| Unit                                | MJ-Eq | MJ-Eq | MJ-Eq | kg   | m3      | m3   | kg waste | kg waste | m3    | m3       | kg   | kg    |
| Minimum                             | 8670  | 243   | 8470  | 223  | 0.00416 | 1.03 | 71.7     | 0.0067   | 0.105 | 8.34e-06 | 0    | 1.33  |
| Maximum                             | 12200 | 346   | 11900 | 314  | 0.00587 | 12.6 | 111      | 0.00982  | 0.205 | 8.34e-06 | 0    | 1.33  |
| Mean                                | 9500  | 267   | 9240  | 243  | 0.00453 | 10.2 | 76.2     | 0.00719  | 0.189 | 8.34e-06 | 0    | 1.33  |
| Median                              | 9390  | 264   | 9150  | 241  | 0.00448 | 9.91 | 75.7     | 0.00712  | 0.189 | 8.34e-06 | 0    | 1.33  |
| 210 DIRECTO ECOPACT                 | 8990  | 254   | 8730  | 230  | 0.00434 | 9.13 | 77.2     | 0.00708  | 0.178 | 8.34e-06 | 0    | 1.33  |
| 210 DIRECTO CON TEMPERATURA ECOPACT | 9020  | 253   | 8740  | 230  | 0.00432 | 9.13 | 77.2     | 0.00708  | 0.178 | 8.34e-06 | 0    | 1.33  |
| 210 DIRECTO CON                     | 9000  | 253   | 8720  | 231  | 0.00435 | 9.14 | 77.3     | 0.00709  | 0.178 | 8.34e-06 | 0    | 1.33  |



|   |      |     |      |     |         |      |      |         |       |          |   |      |
|---|------|-----|------|-----|---------|------|------|---------|-------|----------|---|------|
| RETARDANT E ECOPACT                               |      |     |      |     |         |      |      |         |       |          |   |      |
| 210 DIRECTO CON RETARDANT E Y TEMPERATURA ECOPACT | 8980 | 255 | 8760 | 231 | 0.00423 | 9.14 | 77.3 | 0.00709 | 0.178 | 8.34e-06 | 0 | 1.33 |
| 210 DIRECTO CON FIBRA ECOPACT                     | 9230 | 262 | 8990 | 237 | 0.00446 | 8.95 | 78.8 | 0.00723 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 DIRECTO CON FIBRA Y RETARDANT E ECOPACT       | 9280 | 261 | 9020 | 238 | 0.00446 | 8.95 | 78.8 | 0.00724 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT      | 9270 | 260 | 9020 | 237 | 0.00441 | 8.95 | 78.8 | 0.00723 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA ECOPACT                                 | 8790 | 246 | 8560 | 225 | 0.00422 | 9.81 | 73.7 | 0.00683 | 0.184 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA CON TEMPERATURA ECOPACT                 | 8820 | 247 | 8510 | 225 | 0.00425 | 9.81 | 73.7 | 0.00683 | 0.184 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA CON RETARDANT E ECOPACT                 | 8770 | 246 | 8540 | 225 | 0.00418 | 10.4 | 71.7 | 0.00672 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA CON RETARDANT E Y TEMPERATURA ECOPACT   | 8810 | 243 | 8560 | 225 | 0.00424 | 10.4 | 71.7 | 0.00672 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA CON FIBRA ECOPACT                       | 9040 | 253 | 8790 | 232 | 0.0043  | 9.83 | 75.3 | 0.00698 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA CON FIBRA Y RETARDANT E ECOPACT         | 9020 | 252 | 8790 | 232 | 0.00437 | 10.4 | 73.2 | 0.00687 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT        | 9050 | 253 | 8810 | 232 | 0.00427 | 9.83 | 75.3 | 0.00698 | 0.189 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA PP ECOPACT                              | 8700 | 246 | 8480 | 223 | 0.00422 | 10.3 | 71.7 | 0.0067  | 0.184 | 8.34e-06 | 0 | 1.33 |
| 210 BOMBA PP CON                                  | 8670 | 246 | 8470 | 223 | 0.00416 | 10.3 | 71.7 | 0.0067  | 0.184 | 8.34e-06 | 0 | 1.33 |



|   |           |         |      |     |             |      |      |             |       |              |   |      |
|---|-----------|---------|------|-----|-------------|------|------|-------------|-------|--------------|---|------|
| TEMPERATURA ECOPACT                                 |           |         |      |     |             |      |      |             |       |              |   |      |
| 210 SEMIFLUIDO ECOPACT                              | 9350      | 26<br>1 | 9050 | 240 | 0.0044<br>9 | 9.89 | 75.8 | 0.0071<br>1 | 0.189 | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO CON TEMPERATURA ECOPACT              | 9370      | 26<br>4 | 9060 | 238 | 0.0045<br>2 | 9.89 | 75.8 | 0.0071<br>1 | 0.189 | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO CON RETARDANTE ECOPACT               | 9380      | 26<br>3 | 9130 | 240 | 0.0044<br>7 | 9.9  | 75.9 | 0.0071<br>2 | 0.189 | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT | 9370      | 26<br>3 | 9140 | 240 | 0.0044<br>1 | 9.9  | 75.9 | 0.0071<br>2 | 0.189 | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO CON FIBRA ECOPACT                    | 9390      | 26<br>2 | 9140 | 240 | 0.0044<br>9 | 9.91 | 76.6 | 0.0071<br>6 | 0.2   | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT       | 9460      | 26<br>4 | 9170 | 241 | 0.0045<br>4 | 9.91 | 76.7 | 0.0071<br>7 | 0.2   | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT     | 9360      | 26<br>4 | 9150 | 241 | 0.0044<br>8 | 9.91 | 76.6 | 0.0071<br>6 | 0.2   | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO 3/8 ECOPACT                          | 9980      | 27<br>8 | 9680 | 255 | 0.0047<br>2 | 11.6 | 73.9 | 0.0072<br>3 | 0.2   | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT           | 1010<br>0 | 28<br>2 | 9840 | 259 | 0.0047<br>5 | 11.6 | 74.6 | 0.0073<br>1 | 0.2   | 8.34e-<br>06 | 0 | 1.33 |
| 210 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT          | 9960      | 28<br>0 | 9640 | 255 | 0.0047<br>6 | 11.6 | 73.9 | 0.0072<br>3 | 0.2   | 8.34e-<br>06 | 0 | 1.33 |



|  |       |     |       |     |         |      |      |         |       |          |   |      |
|--|-------|-----|-------|-----|---------|------|------|---------|-------|----------|---|------|
| <b>210 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 10100 | 283 | 9790  | 258 | 0.00469 | 11.6 | 74.6 | 0.00731 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO ECOPACT</b>                                      | 9380  | 264 | 9110  | 241 | 0.00447 | 11.4 | 73   | 0.007   | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO CON TEMPERATURA ECOPACT</b>                      | 9400  | 261 | 9150  | 241 | 0.00444 | 11.4 | 73   | 0.007   | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO CON RETARDANTE ECOPACT</b>                       | 9420  | 265 | 9170  | 242 | 0.00448 | 11.4 | 73   | 0.00701 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT</b>         | 9420  | 264 | 9160  | 242 | 0.00442 | 11.4 | 73   | 0.00701 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO CON FIBRA ECOPACT</b>                            | 9550  | 266 | 9280  | 245 | 0.00445 | 11.4 | 73.9 | 0.00708 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO CON FIBRA Y RETARDANTE ECOPACT</b>               | 9580  | 269 | 9310  | 245 | 0.00455 | 11.3 | 73.9 | 0.00709 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT</b>             | 9570  | 267 | 9310  | 245 | 0.00452 | 11.3 | 73.9 | 0.00709 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO 3/8 ECOPACT</b>                                  | 10300 | 286 | 10000 | 263 | 0.0049  | 11.6 | 75.7 | 0.00743 | 0.205 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO 3/8 CON RETARDANTE ECOPACT</b>                   | 10300 | 289 | 10000 | 264 | 0.00488 | 11.6 | 75.8 | 0.00744 | 0.205 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO 3/8 CON TEMPERATURA ECOPACT</b>                  | 10300 | 289 | 10000 | 264 | 0.0049  | 11.6 | 75.7 | 0.00743 | 0.205 | 8.34e-06 | 0 | 1.33 |
| <b>210 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT</b>     | 10300 | 290 | 10000 | 264 | 0.00491 | 11.6 | 75.8 | 0.00744 | 0.205 | 8.34e-06 | 0 | 1.33 |



|  |       |     |       |     |         |      |      |         |       |          |   |      |
|--|-------|-----|-------|-----|---------|------|------|---------|-------|----------|---|------|
| <b>210 LANZADO ECOPACT</b>                 | 10300 | 289 | 9960  | 263 | 0.00483 | 12.6 | 73.6 | 0.00734 | 0.184 | 8.34e-06 | 0 | 1.33 |
| <b>210 LANZADO CON TEMPERATURA ECOPACT</b> | 10200 | 287 | 9970  | 263 | 0.00483 | 12.6 | 73.6 | 0.00734 | 0.184 | 8.34e-06 | 0 | 1.33 |
| <b>210 PERMEABLE ECOPACT</b>               | 12200 | 346 | 11900 | 314 | 0.00587 | 1.03 | 111  | 0.00982 | 0.105 | 8.34e-06 | 0 | 1.33 |
| <b>245 DIRECTO ECOPACT</b>                 | 9500  | 270 | 9210  | 243 | 0.00457 | 8.36 | 81.2 | 0.00744 | 0.184 | 8.34e-06 | 0 | 1.33 |
| <b>245 BOMBA ECOPACT</b>                   | 9580  | 269 | 9340  | 246 | 0.00456 | 9.31 | 79.1 | 0.00735 | 0.189 | 8.34e-06 | 0 | 1.33 |
| <b>250 DIRECTO ECOPACT</b>                 | 9480  | 267 | 9260  | 244 | 0.00452 | 8.36 | 81.2 | 0.00744 | 0.184 | 8.34e-06 | 0 | 1.33 |
| <b>250 BOMBA ECOPACT</b>                   | 9540  | 270 | 9280  | 245 | 0.00457 | 9.31 | 79.1 | 0.00735 | 0.189 | 8.34e-06 | 0 | 1.33 |

### 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 m<sup>3</sup> of concrete basis.

#### a) Midpoint Impact Categories:

| Indicator/LCI Metric                                    | AP                          | EP    | GWP                    | ODP          | PCOP                   | ADPe     | ADPf                    |
|---|-----------------------------|-------|------------------------|--------------|------------------------|----------|-------------------------|
| Unit  | moles of H <sup>+</sup> -Eq | kg N  | kg CO <sub>2</sub> -Eq | kg CFC-11-Eq | kg NO <sub>x</sub> -Eq | kg Sb-Eq | MJ, net calorific value |
| Minimum   | 111                         | 0.189 | 592                    | 6.62e-05     | 1.46                   | 0.00388  | 9260                    |
| Maximum   | 135                         | 0.231 | 736                    | 8.11e-05     | 1.76                   | 0.00484  | 11600                   |
| Mean  | 118                         | 0.201 | 639                    | 7.05e-05     | 1.54                   | 0.0042   | 10100                   |
| Median  | 116                         | 0.197 | 624                    | 6.89e-05     | 1.5                    | 0.0041   | 9840                    |
| <b>280 DIRECTO ECOPACT</b>                              | 111                         | 0.189 | 592                    | 6.62e-05     | 1.46                   | 0.00388  | 9260                    |
| <b>280 DIRECTO CON TEMPERATURA ECOPACT</b>              | 111                         | 0.189 | 592                    | 6.63e-05     | 1.46                   | 0.00388  | 9270                    |
| <b>280 DIRECTO CON RETARDANTE ECOPACT</b>               | 111                         | 0.189 | 592                    | 6.63e-05     | 1.46                   | 0.00388  | 9270                    |
| <b>280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 111                         | 0.189 | 592                    | 6.63e-05     | 1.46                   | 0.00388  | 9270                    |
| <b>280 DIRECTO CON FIBRA ECOPACT</b>                    | 112                         | 0.191 | 599                    | 6.7e-05      | 1.47                   | 0.00393  | 9400                    |
| <b>280 DIRECTO CON FIBRA Y</b>                          | 112                         | 0.191 | 600                    | 6.7e-05      | 1.47                   | 0.00393  | 9410                    |





|  |     |       |     |          |      |         |      |
|--|-----|-------|-----|----------|------|---------|------|
| RETARDANTE<br>ECOPACT  |     |       |     |          |      |         |      |
| 280 DIRECTO CON<br>FRIBRA Y<br>TEMPERATURA<br>ECOPACT        | 112 | 0.191 | 599 | 6.7e-05  | 1.47 | 0.00393 | 9400 |
| 280 BOMBA<br>ECOPACT   | 114 | 0.196 | 616 | 6.84e-05 | 1.5  | 0.00405 | 9700 |
| 280 BOMBA CON<br>TEMPERATURA<br>ECOPACT                      | 114 | 0.196 | 616 | 6.84e-05 | 1.5  | 0.00405 | 9700 |
| 280 BOMBA CON<br>RETARDANTE<br>ECOPACT                       | 115 | 0.196 | 617 | 6.85e-05 | 1.5  | 0.00405 | 9700 |
| 280 BOMBA CON<br>RETARDANTE Y<br>TEMPERATURA<br>ECOPACT      | 115 | 0.196 | 617 | 6.85e-05 | 1.5  | 0.00405 | 9700 |
| 280 BOMBA CON<br>FIBRA ECOPACT                               | 116 | 0.198 | 624 | 6.91e-05 | 1.52 | 0.0041  | 9830 |
| 280 BOMBA CON<br>FIBRA Y<br>RETARDANTE<br>ECOPACT            | 116 | 0.198 | 624 | 6.92e-05 | 1.52 | 0.00411 | 9840 |
| 280 BOMBA CON<br>FRIBRA Y<br>TEMPERATURA<br>ECOPACT          | 116 | 0.198 | 624 | 6.91e-05 | 1.52 | 0.0041  | 9830 |
| 280 BOMBA PP<br>ECOPACT                                      | 113 | 0.193 | 612 | 6.77e-05 | 1.48 | 0.00402 | 9630 |
| 280 BOMBA PP CON<br>TEMPERATURA<br>ECOPACT                   | 113 | 0.193 | 612 | 6.77e-05 | 1.48 | 0.00402 | 9630 |
| 280 SEMIFLUIDO<br>ECOPACT                                    | 113 | 0.193 | 615 | 6.76e-05 | 1.48 | 0.00404 | 9680 |
| 280 SEMIFLUIDO<br>CON TEMPERATURA<br>ECOPACT                 | 113 | 0.193 | 615 | 6.76e-05 | 1.48 | 0.00404 | 9680 |
| 280 SEMIFLUIDO<br>CON RETARDANTE<br>ECOPACT                  | 113 | 0.193 | 616 | 6.77e-05 | 1.48 | 0.00404 | 9700 |
| 280 SEMIFLUIDO<br>CON RETARDANTE Y<br>TEMPERATURA<br>ECOPACT | 113 | 0.193 | 616 | 6.77e-05 | 1.48 | 0.00404 | 9700 |
| 280 SEMIFLUIDO<br>CON FIBRA<br>ECOPACT                       | 114 | 0.195 | 623 | 6.84e-05 | 1.49 | 0.00409 | 9820 |
| 280 SEMIFLUIDO<br>CON FIBRA Y<br>RETARDANTE<br>ECOPACT       | 114 | 0.195 | 623 | 6.84e-05 | 1.49 | 0.0041  | 9840 |



|   |     |       |     |          |      |         |       |
|---|-----|-------|-----|----------|------|---------|-------|
| 280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT         | 114 | 0.195 | 623 | 6.84e-05 | 1.49 | 0.00409 | 9820  |
| 280 SEMIFLUIDO 3/8 ECOPACT                              | 120 | 0.206 | 656 | 7.21e-05 | 1.57 | 0.00431 | 10300 |
| 280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT               | 121 | 0.208 | 663 | 7.28e-05 | 1.58 | 0.00436 | 10400 |
| 280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT              | 120 | 0.206 | 656 | 7.21e-05 | 1.57 | 0.00431 | 10300 |
| 280 SEMIFLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT | 121 | 0.208 | 663 | 7.28e-05 | 1.58 | 0.00436 | 10400 |
| 280 FLUIDO ECOPACT                                      | 115 | 0.196 | 627 | 6.87e-05 | 1.5  | 0.00412 | 9880  |
| 280 FLUIDO CON TEMPERATURA ECOPACT                      | 115 | 0.196 | 627 | 6.87e-05 | 1.5  | 0.00412 | 9880  |
| 280 FLUIDO CON RETARDANTE ECOPACT                       | 116 | 0.198 | 634 | 6.94e-05 | 1.51 | 0.00416 | 9990  |
| 280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT         | 116 | 0.198 | 634 | 6.94e-05 | 1.51 | 0.00416 | 9990  |
| 280 FLUIDO CON FIBRA ECOPACT                            | 116 | 0.198 | 634 | 6.93e-05 | 1.51 | 0.00417 | 10000 |
| 280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT               | 116 | 0.198 | 634 | 6.94e-05 | 1.51 | 0.00417 | 10000 |
| 280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT             | 116 | 0.198 | 634 | 6.93e-05 | 1.51 | 0.00417 | 10000 |
| 280 FLUIDO 3/8 ECOPACT                                  | 124 | 0.213 | 681 | 7.46e-05 | 1.62 | 0.00447 | 10700 |
| 280 FLUIDO 3/8 CON RETARDANTE ECOPACT                   | 124 | 0.213 | 682 | 7.46e-05 | 1.62 | 0.00448 | 10700 |
| 280 FLUIDO 3/8 CON TEMPERATURA ECOPACT                  | 124 | 0.213 | 681 | 7.46e-05 | 1.62 | 0.00447 | 10700 |
| 280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT     | 124 | 0.213 | 682 | 7.46e-05 | 1.62 | 0.00448 | 10700 |
| 280 LANZADO ECOPACT                                     | 120 | 0.207 | 671 | 7.27e-05 | 1.57 | 0.00438 | 10500 |



|  |     |       |     |          |      |         |       |
|--|-----|-------|-----|----------|------|---------|-------|
| 280 LANZADO CON TEMPERATURA ECOPACT            | 120 | 0.206 | 670 | 7.24e-05 | 1.56 | 0.00437 | 10500 |
| 300 BOMBA ECOPACT                              | 135 | 0.231 | 735 | 8.1e-05  | 1.76 | 0.00483 | 11500 |
| 300 BOMBA CON RETARDANTE ECOPACT               | 135 | 0.231 | 736 | 8.11e-05 | 1.76 | 0.00484 | 11600 |
| 300 BOMBA CON TEMPERATURA ECOPACT              | 135 | 0.231 | 735 | 8.1e-05  | 1.76 | 0.00483 | 11500 |
| 300 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT | 135 | 0.231 | 736 | 8.11e-05 | 1.76 | 0.00484 | 11600 |

b) Inventory Metrics:

| Indicator/LC I Metric                            | TPE   | RE    | NRE   | NR R | RR      | WD P | LFW      | LFHW     | CBW C | CWW C    | CH W | CNH W |
|--|-------|-------|-------|------|---------|------|----------|----------|-------|----------|------|-------|
| Unit   | MJ-Eq | MJ-Eq | MJ-Eq | kg   | m3      | m3   | kg waste | kg waste | m3    | m3       | kg   | kg    |
| Minimum  | 10300 | 291   | 10000 | 265  | 0.00491 | 7.21 | 83.9     | 0.008    | 0.184 | 8.34e-06 | 0    | 1.33  |
| Maximum  | 12900 | 365   | 12600 | 331  | 0.00617 | 13.1 | 103      | 0.00964  | 0.205 | 8.34e-06 | 0    | 1.33  |
| Mean   | 11200 | 316   | 10900 | 287  | 0.00533 | 9.06 | 88.8     | 0.00838  | 0.198 | 8.34e-06 | 0    | 1.33  |
| Median   | 11000 | 307   | 10700 | 282  | 0.00524 | 9.04 | 88.4     | 0.00817  | 0.2   | 8.34e-06 | 0    | 1.33  |
| 280 DIRECTO ECOPACT                              | 10300 | 291   | 10000 | 265  | 0.00499 | 7.65 | 88.1     | 0.00806  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 280 DIRECTO CON TEMPERATURA ECOPACT              | 10300 | 295   | 10000 | 265  | 0.00495 | 7.65 | 88.2     | 0.00806  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 280 DIRECTO CON RETARDANTE ECOPACT               | 10300 | 293   | 10000 | 265  | 0.00492 | 7.65 | 88.2     | 0.00806  | 0.184 | 8.34e-06 | 0    | 1.33  |
| 280 DIRECTO CON RETARDANTE Y TEMPERATURA ECOPACT | 10300 | 295   | 10000 | 265  | 0.00491 | 7.65 | 88.2     | 0.00806  | 0.184 | 8.34e-06 | 0    | 1.33  |



|   |       |     |       |     |         |      |      |         |       |          |   |      |
|---|-------|-----|-------|-----|---------|------|------|---------|-------|----------|---|------|
| <b>280 DIRECTO CON FIBRA ECOPACT</b>                  | 10500 | 295 | 10200 | 268 | 0.00491 | 7.67 | 89.1 | 0.00814 | 0.189 | 8.34e-06 | 0 | 1.33 |
| <b>280 DIRECTO CON FIBRA Y RETARDANTE ECOPACT</b>     | 10500 | 294 | 10200 | 268 | 0.00501 | 7.67 | 89.1 | 0.00814 | 0.189 | 8.34e-06 | 0 | 1.33 |
| <b>280 DIRECTO CON FRIBRA Y TEMPERATURA ECOPACT</b>   | 10500 | 295 | 10200 | 268 | 0.00494 | 7.67 | 89.1 | 0.00814 | 0.189 | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA ECOPACT</b>                              | 10800 | 305 | 10500 | 277 | 0.00515 | 8.21 | 88.6 | 0.00823 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA CON TEMPERATURA ECOPACT</b>              | 10800 | 307 | 10500 | 276 | 0.0052  | 8.21 | 88.6 | 0.00823 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA CON RETARDANTE ECOPACT</b>               | 10800 | 303 | 10500 | 277 | 0.00519 | 8.21 | 88.7 | 0.00823 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 10800 | 306 | 10500 | 277 | 0.00512 | 8.21 | 88.7 | 0.00823 | 0.194 | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA CON FIBRA ECOPACT</b>                    | 10900 | 306 | 10600 | 281 | 0.00522 | 8.22 | 89.4 | 0.0083  | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA CON FIBRA Y RETARDANTE ECOPACT</b>       | 11000 | 307 | 10600 | 281 | 0.00524 | 8.23 | 89.4 | 0.00831 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA CON FRIBRA Y TEMPERATURA ECOPACT</b>     | 10900 | 306 | 10600 | 281 | 0.0053  | 8.22 | 89.4 | 0.0083  | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA PP ECOPACT</b>                           | 10700 | 301 | 10400 | 276 | 0.00514 | 9.06 | 86   | 0.00808 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 BOMBA PP CON TEMPERATURA ECOPACT</b>           | 10700 | 303 | 10400 | 276 | 0.00517 | 9.06 | 86   | 0.00808 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO ECOPACT</b>                         | 10800 | 304 | 10500 | 277 | 0.00505 | 10   | 83.9 | 0.008   | 0.2   | 8.34e-06 | 0 | 1.33 |



|  |       |     |       |     |         |      |      |         |       |          |   |      |
|--|-------|-----|-------|-----|---------|------|------|---------|-------|----------|---|------|
| <b>280 SEMIFLUIDO CON TEMPERATURA ECOPACT</b>              | 10800 | 305 | 10400 | 277 | 0.00514 | 10   | 83.9 | 0.008   | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO CON RETARDANTE ECOPACT</b>               | 10800 | 303 | 10500 | 276 | 0.00514 | 10   | 84   | 0.00801 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 10800 | 304 | 10500 | 277 | 0.00521 | 10   | 84   | 0.00801 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO CON FIBRA ECOPACT</b>                    | 11000 | 307 | 10600 | 281 | 0.00514 | 10   | 84.9 | 0.00809 | 0.205 | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO CON FIBRA Y RETARDANTE ECOPACT</b>       | 10900 | 309 | 10700 | 281 | 0.00524 | 10   | 84.9 | 0.00809 | 0.205 | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO CON FRIBRA Y TEMPERATURA ECOPACT</b>     | 11000 | 307 | 10700 | 282 | 0.00523 | 10   | 84.9 | 0.00809 | 0.205 | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO 3/8 ECOPACT</b>                          | 11500 | 324 | 11200 | 295 | 0.00545 | 9.07 | 89.8 | 0.00852 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO 3/8 CON RETARDANTE ECOPACT</b>           | 11600 | 328 | 11300 | 299 | 0.0055  | 9.07 | 90.6 | 0.0086  | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO 3/8 CON TEMPERATURA ECOPACT</b>          | 11500 | 325 | 11200 | 295 | 0.00544 | 9.07 | 89.8 | 0.00852 | 0.2   | 8.34e-06 | 0 | 1.33 |
| <b>280 SEMIFLUIDO 3/8 CON RETARDANTE Y</b>                 | 11600 | 325 | 11300 | 298 | 0.00556 | 9.07 | 90.6 | 0.0086  | 0.2   | 8.34e-06 | 0 | 1.33 |



|   |       |     |       |     |         |      |      |         |       |          |   |      |
|---|-------|-----|-------|-----|---------|------|------|---------|-------|----------|---|------|
| TEMPERATURA ECOPACT                                 |       |     |       |     |         |      |      |         |       |          |   |      |
| 280 FLUIDO ECOPACT                                  | 11000 | 309 | 10700 | 282 | 0.00525 | 10.4 | 84.2 | 0.00809 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO CON TEMPERATURA ECOPACT                  | 11000 | 307 | 10700 | 282 | 0.00529 | 10.4 | 84.2 | 0.00809 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO CON RETARDANTE ECOPACT                   | 11100 | 312 | 10800 | 285 | 0.00525 | 10.5 | 84.9 | 0.00817 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT     | 11100 | 313 | 10800 | 285 | 0.00525 | 10.5 | 84.9 | 0.00817 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO CON FIBRA ECOPACT                        | 11200 | 314 | 10900 | 286 | 0.00527 | 10.5 | 84.7 | 0.00815 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO CON FIBRA Y RETARDANTE ECOPACT           | 11200 | 314 | 10800 | 286 | 0.00521 | 10.5 | 84.8 | 0.00816 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO CON FRIBRA Y TEMPERATURA ECOPACT         | 11200 | 312 | 10800 | 286 | 0.00526 | 10.5 | 84.7 | 0.00815 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO 3/8 ECOPACT                              | 12000 | 335 | 11600 | 306 | 0.00565 | 9.02 | 92   | 0.00878 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO 3/8 CON RETARDANTE ECOPACT               | 12000 | 339 | 11600 | 307 | 0.00565 | 9.02 | 92   | 0.00878 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO 3/8 CON TEMPERATURA ECOPACT              | 11900 | 337 | 11600 | 306 | 0.00579 | 9.02 | 92   | 0.00878 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 FLUIDO 3/8 CON RETARDANTE Y TEMPERATURA ECOPACT | 11900 | 337 | 11600 | 307 | 0.00561 | 9.02 | 92   | 0.00878 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 LANZADO ECOPACT                                 | 11700 | 331 | 11400 | 299 | 0.00551 | 13.1 | 84.2 | 0.00839 | 0.2   | 8.34e-06 | 0 | 1.33 |
| 280 LANZADO   | 11700 | 329 | 11400 | 301 | 0.00556 | 11.8 | 83.9 | 0.00834 | 0.2   | 8.34e-06 | 0 | 1.33 |



|   |           |         |           |     |             |      |     |             |     |              |   |      |
|---|-----------|---------|-----------|-----|-------------|------|-----|-------------|-----|--------------|---|------|
| CON<br>TEMPERATU<br>RA ECOPACT                                  |           |         |           |     |             |      |     |             |     |              |   |      |
| 300 BOMBA<br>ECOPACT  | 1280<br>0 | 36<br>0 | 1250<br>0 | 330 | 0.0061<br>7 | 7.21 | 103 | 0.0096<br>4 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| 300 BOMBA<br>CON<br>RETARDANT<br>E ECOPACT                      | 1290<br>0 | 36<br>4 | 1250<br>0 | 331 | 0.0060<br>6 | 7.21 | 103 | 0.0096<br>4 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| 300 BOMBA<br>CON<br>TEMPERATU<br>RA ECOPACT                     | 1290<br>0 | 36<br>4 | 1250<br>0 | 331 | 0.0061<br>4 | 7.21 | 103 | 0.0096<br>4 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| 300 BOMBA<br>CON<br>RETARDANT<br>E Y<br>TEMPERATU<br>RA ECOPACT | 1290<br>0 | 36<br>5 | 1260<br>0 | 330 | 0.0061<br>6 | 7.21 | 103 | 0.0096<br>4 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |

### 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 <sup>+</sup> -Eq | kg N  | kg CO <sub>2</sub> -Eq | kg CFC-11-Eq | kg NO <sub>x</sub> -Eq | kg Sb-Eq | MJ, net calorific value |
| Minimum   | 131                         | 0.224 | 713                    | 7.85e-05     | 1.7                    | 0.00469  | 11200                   |
| Maximum   | 139                         | 0.237 | 759                    | 8.33e-05     | 1.8                    | 0.005    | 12000                   |
| Mean  | 136                         | 0.232 | 740                    | 8.12e-05     | 1.76                   | 0.00486  | 11600                   |
| Median  | 136                         | 0.234 | 746                    | 8.2e-05      | 1.78                   | 0.0049   | 11700                   |
| 350 BOMBA<br>ECOPACT                                    | 136                         | 0.233 | 746                    | 8.19e-05     | 1.77                   | 0.0049   | 11700                   |
| 350 BOMBA CON<br>RETARDANTE<br>ECOPACT                  | 137                         | 0.234 | 747                    | 8.2e-05      | 1.78                   | 0.00491  | 11700                   |
| 350 BOMBA CON<br>TEMPERATURA<br>ECOPACT                 | 136                         | 0.233 | 746                    | 8.19e-05     | 1.77                   | 0.0049   | 11700                   |
| 350 BOMBA CON<br>RETARDANTE Y<br>TEMPERATURA<br>ECOPACT | 137                         | 0.234 | 747                    | 8.2e-05      | 1.78                   | 0.00491  | 11700                   |
| 350 SEMIFLUIDO<br>ECOPACT                               | 131                         | 0.224 | 713                    | 7.85e-05     | 1.7                    | 0.00469  | 11200                   |



|   |     |       |     |          |     |         |       |
|---|-----|-------|-----|----------|-----|---------|-------|
| 350 SEMIFLUIDO CON RETARDANTE ECOPACT               | 131 | 0.224 | 714 | 7.86e-05 | 1.7 | 0.0047  | 11200 |
| 350 SEMIFLUIDO CON TEMPERATURA ECOPACT              | 131 | 0.224 | 713 | 7.85e-05 | 1.7 | 0.00469 | 11200 |
| 350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT | 131 | 0.224 | 714 | 7.85e-05 | 1.7 | 0.0047  | 11200 |
| 350 FLUIDO ECOPACT                                  | 139 | 0.237 | 759 | 8.32e-05 | 1.8 | 0.00499 | 11900 |
| 350 FLUIDO CON RETARDANTE ECOPACT                   | 139 | 0.237 | 759 | 8.33e-05 | 1.8 | 0.005   | 12000 |
| 350 FLUIDO CON TEMPERATURA ECOPACT                  | 139 | 0.237 | 759 | 8.32e-05 | 1.8 | 0.00499 | 11900 |
| 350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT     | 139 | 0.237 | 759 | 8.33e-05 | 1.8 | 0.005   | 12000 |

b) Inventory Metrics:

| Indicator/LC I Metric             | TPE   | RE    | NRE   | NR R | RR      | WD P | LFW      | LFHW     | CBW C | CWW C    | CH W | CNH W |
|-----------------------------------|-------|-------|-------|------|---------|------|----------|----------|-------|----------|------|-------|
| Unit                              | MJ-Eq | MJ-Eq | MJ-Eq | kg   | m3      | m3   | kg waste | kg waste | m3    | m3       | kg   | kg    |
| Minimum                           | 12500 | 350   | 12100 | 320  | 0.00584 | 7.73 | 99.1     | 0.00931  | 0.2   | 8.34e-06 | 0    | 1.33  |
| Maximum                           | 13300 | 381   | 13000 | 342  | 0.00638 | 7.91 | 104      | 0.00983  | 0.205 | 8.34e-06 | 0    | 1.33  |
| Mean                              | 13000 | 365   | 12600 | 332  | 0.00616 | 7.81 | 102      | 0.00962  | 0.203 | 8.34e-06 | 0    | 1.33  |
| Median                            | 13100 | 368   | 12700 | 334  | 0.0062  | 7.84 | 103      | 0.0097   | 0.205 | 8.34e-06 | 0    | 1.33  |
| 350 BOMBA ECOPACT                 | 13100 | 365   | 12700 | 334  | 0.00629 | 7.73 | 103      | 0.0097   | 0.2   | 8.34e-06 | 0    | 1.33  |
| 350 BOMBA CON RETARDANTE ECOPACT  | 13100 | 369   | 12700 | 335  | 0.00621 | 7.73 | 103      | 0.00971  | 0.2   | 8.34e-06 | 0    | 1.33  |
| 350 BOMBA CON TEMPERATURA ECOPACT | 13000 | 369   | 12600 | 334  | 0.00616 | 7.73 | 103      | 0.0097   | 0.2   | 8.34e-06 | 0    | 1.33  |
| 350 BOMBA CON RETARDANTE Y        | 13100 | 368   | 12800 | 335  | 0.0062  | 7.73 | 103      | 0.00971  | 0.2   | 8.34e-06 | 0    | 1.33  |





|   |       |     |       |     |         |      |      |         |       |          |   |      |
|---|-------|-----|-------|-----|---------|------|------|---------|-------|----------|---|------|
| TEMPERATURA ECOPACT                                 |       |     |       |     |         |      |      |         |       |          |   |      |
| 350 SEMIFLUIDO ECOPACT                              | 12500 | 352 | 12200 | 321 | 0.00595 | 7.91 | 99.1 | 0.00932 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 SEMIFLUIDO CON RETARDANTE ECOPACT               | 12500 | 350 | 12200 | 320 | 0.00605 | 7.87 | 99.1 | 0.00932 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 SEMIFLUIDO CON TEMPERATURA ECOPACT              | 12500 | 351 | 12200 | 321 | 0.00584 | 7.87 | 99.1 | 0.00931 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT | 12500 | 353 | 12100 | 321 | 0.00595 | 7.78 | 99.1 | 0.00932 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 FLUIDO ECOPACT                                  | 13300 | 377 | 13000 | 342 | 0.00628 | 7.84 | 104  | 0.00982 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 FLUIDO CON RETARDANTE ECOPACT                   | 13300 | 372 | 12900 | 342 | 0.00638 | 7.84 | 104  | 0.00983 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 FLUIDO CON TEMPERATURA ECOPACT                  | 13300 | 375 | 12900 | 341 | 0.00629 | 7.84 | 104  | 0.00982 | 0.205 | 8.34e-06 | 0 | 1.33 |
| 350 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT     | 13300 | 381 | 13000 | 342 | 0.0063  | 7.84 | 104  | 0.00983 | 0.205 | 8.34e-06 | 0 | 1.33 |

### 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 m<sup>3</sup> of concrete basis.

a) Midpoint Impact Categories:

| Indicator/LCI Metric | AP                          | EP    | GWP                    | ODP          | PCOP                   | ADPe     | ADPf                    |
|----------------------|-----------------------------|-------|------------------------|--------------|------------------------|----------|-------------------------|
| Unit                 | moles of H <sup>+</sup> -Eq | kg N  | kg CO <sub>2</sub> -Eq | kg CFC-11-Eq | kg NO <sub>x</sub> -Eq | kg Sb-Eq | MJ, net calorific value |
| Minimum              | 130                         | 0.222 | 707                    | 7.79e-05     | 1.69                   | 0.00465  | 11100                   |



|  |     |       |     |          |      |         |       |
|--|-----|-------|-----|----------|------|---------|-------|
| <b>Maximum</b>   | 133 | 0.228 | 727 | 8e-05    | 1.73 | 0.00479 | 11500 |
| <b>Mean</b>  | 132 | 0.226 | 720 | 7.93e-05 | 1.72 | 0.00474 | 11300 |
| <b>Median</b>  | 133 | 0.228 | 727 | 7.99e-05 | 1.73 | 0.00478 | 11400 |
| <b>420 BOMBA ECOPACT</b>                                   | 130 | 0.222 | 708 | 7.8e-05  | 1.69 | 0.00465 | 11100 |
| <b>420 BOMBA CON RETARDANTE ECOPACT</b>                    | 130 | 0.222 | 708 | 7.8e-05  | 1.69 | 0.00466 | 11100 |
| <b>420 BOMBA CON TEMPERATURA ECOPACT</b>                   | 130 | 0.222 | 707 | 7.79e-05 | 1.69 | 0.00465 | 11100 |
| <b>420 BOMBA CON RETARDANTE Y TEMPERATURA ECOPACT</b>      | 130 | 0.222 | 707 | 7.79e-05 | 1.69 | 0.00465 | 11100 |
| <b>420 SEMIFLUIDO ECOPACT</b>                              | 133 | 0.228 | 727 | 7.99e-05 | 1.73 | 0.00478 | 11400 |
| <b>420 SEMIFLUIDO CON RETARDANTE ECOPACT</b>               | 133 | 0.228 | 727 | 8e-05    | 1.73 | 0.00479 | 11400 |
| <b>420 SEMIFLUIDO CON TEMPERATURA ECOPACT</b>              | 133 | 0.228 | 727 | 7.99e-05 | 1.73 | 0.00478 | 11400 |
| <b>420 SEMIFLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT</b> | 133 | 0.228 | 727 | 8e-05    | 1.73 | 0.00479 | 11400 |
| <b>420 FLUIDO ECOPACT</b>                                  | 133 | 0.228 | 727 | 7.99e-05 | 1.73 | 0.00478 | 11400 |
| <b>420 FLUIDO CON RETARDANTE ECOPACT</b>                   | 133 | 0.228 | 727 | 8e-05    | 1.73 | 0.00479 | 11500 |
| <b>420 FLUIDO CON TEMPERATURA ECOPACT</b>                  | 133 | 0.228 | 727 | 7.99e-05 | 1.73 | 0.00478 | 11400 |
| <b>420 FLUIDO CON RETARDANTE Y TEMPERATURA ECOPACT</b>     | 133 | 0.228 | 727 | 8e-05    | 1.73 | 0.00479 | 11500 |

## b) Inventory Metrics:

| Indicator/LC I Metric | TPE   | RE    | NRE   | NR R | RR      | WD P | LFW      | LFHW     | CBW C | CWW C    | CH W | CNH W |
|-----------------------|-------|-------|-------|------|---------|------|----------|----------|-------|----------|------|-------|
| Unit                  | MJ-Eq | MJ-Eq | MJ-Eq | kg   | m3      | m3   | kg waste | kg waste | m3    | m3       | kg   | kg    |
| <b>Minimum</b>        | 12400 | 346   | 12000 | 317  | 0.00585 | 7.92 | 98.6     | 0.00926  | 0.2   | 8.34e-06 | 0    | 1.33  |
| <b>Maximum</b>        | 12800 | 362   | 12400 | 328  | 0.00618 | 7.99 | 101      | 0.00948  | 0.2   | 8.34e-06 | 0    | 1.33  |



|  |           |         |           |     |             |      |      |             |     |              |   |      |
|--|-----------|---------|-----------|-----|-------------|------|------|-------------|-----|--------------|---|------|
| Mean   | 1260<br>0 | 35<br>6 | 1230<br>0 | 324 | 0.006       | 7.95 | 100  | 0.0094      | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| Median   | 1270<br>0 | 35<br>9 | 1230<br>0 | 327 | 0.0060<br>2 | 7.93 | 101  | 0.0094<br>7 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 BOMBA<br/>ECOPACT</b>   | 1240<br>0 | 351     | 1210<br>0 | 317 | 0.0058<br>9 | 7.99 | 98.7 | 0.0092<br>6 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 BOMBA<br/>CON<br/>RETARDANT<br/>E ECOPACT</b>                                 | 1240<br>0 | 34<br>8 | 1200<br>0 | 319 | 0.0058<br>6 | 7.99 | 98.7 | 0.0092<br>7 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 BOMBA<br/>CON<br/>TEMPERATU<br/>RA ECOPACT</b>                                | 1240<br>0 | 34<br>6 | 1200<br>0 | 318 | 0.0058<br>5 | 7.99 | 98.6 | 0.0092<br>6 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 BOMBA<br/>CON<br/>RETARDANT<br/>E Y<br/>TEMPERATU<br/>RA ECOPACT</b>          | 1240<br>0 | 35<br>4 | 1210<br>0 | 319 | 0.0058<br>5 | 7.99 | 98.6 | 0.0092<br>6 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420<br/>SEMIFLUIDO<br/>ECOPACT</b>  | 1270<br>0 | 36<br>0 | 1230<br>0 | 326 | 0.0061<br>4 | 7.92 | 101  | 0.0094<br>7 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420<br/>SEMIFLUIDO<br/>CON<br/>RETARDANT<br/>E ECOPACT</b>                        | 1280<br>0 | 35<br>8 | 1240<br>0 | 327 | 0.0061<br>8 | 7.93 | 101  | 0.0094<br>8 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420<br/>SEMIFLUIDO<br/>CON<br/>TEMPERATU<br/>RA ECOPACT</b>                       | 1270<br>0 | 35<br>9 | 1230<br>0 | 327 | 0.0060<br>6 | 7.92 | 101  | 0.0094<br>7 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420<br/>SEMIFLUIDO<br/>CON<br/>RETARDANT<br/>E Y<br/>TEMPERATU<br/>RA ECOPACT</b> | 1270<br>0 | 36<br>2 | 1240<br>0 | 328 | 0.0060<br>7 | 7.93 | 101  | 0.0094<br>8 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 FLUIDO<br/>ECOPACT</b>  | 1280<br>0 | 36<br>1 | 1240<br>0 | 327 | 0.0059<br>9 | 7.92 | 101  | 0.0094<br>7 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 FLUIDO<br/>CON<br/>RETARDANT<br/>E ECOPACT</b>                                | 1280<br>0 | 36<br>0 | 1240<br>0 | 327 | 0.0060<br>6 | 7.93 | 101  | 0.0094<br>8 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 FLUIDO<br/>CON<br/>TEMPERATU<br/>RA ECOPACT</b>                               | 1270<br>0 | 35<br>9 | 1230<br>0 | 327 | 0.0059<br>7 | 7.92 | 101  | 0.0094<br>7 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |
| <b>420 FLUIDO<br/>CON</b>  | 1280<br>0 | 35<br>9 | 1240<br>0 | 327 | 0.0060<br>9 | 7.93 | 101  | 0.0094<br>8 | 0.2 | 8.34e-<br>06 | 0 | 1.33 |





|   |  |  |  |  |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|--|--|--|
| RETARDANT<br>E Y<br>TEMPERATU<br>RA ECOPACT |  |  |  |  |  |  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|--|--|--|--|--|

**ADDITIONAL ENVIRONMENTAL INFO**

No regulated substances of very high concern are utilized on site.

**REFERENCES**

**ASTM Standards:**

- ASTM A36/A36M Standard Specification for Carbon Structural Steel
- ASTM A108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
- ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A184 Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
- ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
- ASTM A416/A416M Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
- ASTM A555/A555M Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods
- ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
- ASTM A706/A706M Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
- ASTM A767/A767M Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
- ASTM A775/A775M Standard Specification for Epoxy-Coated Steel Reinforcing Bars
- ASTM A820/A820M Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
- ASTM A884/A884M Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
- ASTM A934/A934M Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
- ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- ASTM C33/C33M Standard Specification for Concrete Aggregates
- ASTM C94 Standard Specification for Ready-Mixed Concrete



- ASTM C150/C150M Standard Specification for Portland Cement
- ASTM C260/C260M Standard Specification for Air-Entraining Admixtures for Concrete
- ASTM C595 Standard Specification for Blended Hydraulic Cements
- ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- ASTM C979/C979M Standard Specification for Pigments for Integrally Colored Concrete
- ASTM C989/C989M Standard Specification for Slag Cement for Use in Concrete and Mortars
- ASTM C1017/C1017M Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- ASTM C1116/C1116M Standard Specification for Fiber-Reinforced Concrete
- ASTM C1157/C1157M Standard Performance Specification for Hydraulic Cement
- ASTM C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
- ASTM C1602/C1602M Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- ASTM G109 Standard Test Method for Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
- ASTM C330/C330M Standard Specification for Lightweight Aggregates for Structural Concrete
- ASTM C494/C494M Standard Specification for Chemical Admixtures for Concrete

#### CSA Standards:

- CAN/CGSB-1.40 Anticorrosive Structural Steel Alkyd Primer
- CAN/CSA G30.18 Carbon steel bars for concrete reinforcement
- CAN/CSA A3000 Cementitious Materials Compendium
- CAN/CSA G40.20/G40.21 General requirements for rolled or welded structural quality steel / Structural quality steel
- CAN/CSA A23.1/A23.2 Concrete Materials and Methods of Concrete Construction/Test methods and Standard Practices for Concrete
- CAN/CSA A23.4 Precast concrete - Materials and construction
- CSA S806 Design and construction of building structures with fiber-reinforced polymers

#### ISO Standards:

- ISO 6707-1: 2014 Buildings and Civil Engineering Works - Vocabulary - Part 1: General Terms
- ISO 14021:1999 Environmental Labels and Declarations - Self-declared Environmental Claims (Type II Environmental Labeling)
- ISO 14025:2006 Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures
- ISO 14040:2006 Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006 Environmental Management - Life Cycle Assessment - Requirements and Guidelines



- ISO 14067:2018 Greenhouse Gases - Carbon Footprint of Products - Requirements and Guidelines for Quantification
- ISO 14050:2009 Environmental Management - Vocabulary
- ISO 21930:2017 Sustainability in Building Construction - Environmental Declaration of Building Products

#### EN Standards:

- EN 16757 Sustainability of construction works - Environmental product declarations - Product Category Rules for concrete and concrete elements.
- EN 15804 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.

#### Other References:

- US EPA Waste Reduction Model (WARM), Fly Ash  
Chapter: <http://epa.gov/climatechange/wycd/waste/downloads/fly-ash-chapter10-28-10.pdf>
- American Concrete Institute (ACI) 211: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- ACI 318-14 Building Code Requirements for Structural Concrete and Commentary. American Concrete Institute. Farmington Hills, MI, USA available at <https://www.concrete.org/store/>
- Mather, B & Ozyildirim, C. (2002). SP-1(02) : Concrete Primer. American Concrete Institute: SP0102. American Concrete Institute. Farmington Hills, MI, USA available at <https://www.concrete.org/store/>
- NSF International (February 2019). Product Category Rules (PCR) for ISO 14025 Type III Environmental Product Declarations (EPDs) of Concrete v1.2.
- Product Category Rules for Preparing an Environmental Product Declaration for Precast Concrete (UN CPC 37550), ASTM International, March 2015. [https://www.astm.org/CERTIFICATION/DOCS/266.PCR\\_for\\_Precast\\_Concrete.pdf](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>.

