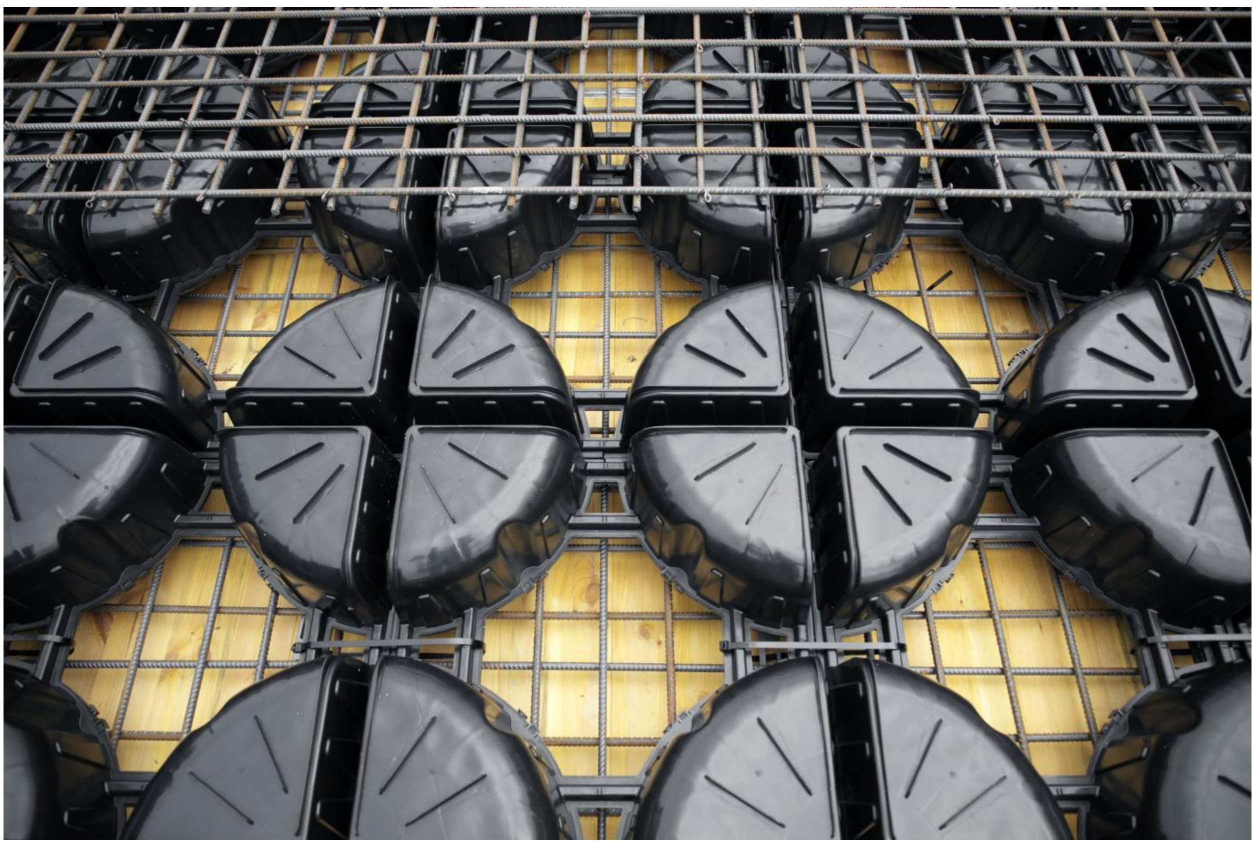
Environmental Product Declaration



Environmental Product Declaration for in-situ concrete slab with void forms produced by Cobiax USA Inc.

ADMINISTRATIVE INFORMATION

International Certified Environmental Product Declaration

Declared Product:	This Environmental Product Declaration (EPD) covers in-situ concrete slab with void former products produced by Cobiax USA Inc. Declared unit: 1 m3 in-situ concrete slabs featuring Cobiax void former modules from the CLS range.
Declaration Owner:	Cobiax USA Inc.
	90 Pleasant St.
	Dedham, Massachusetts 02026
	www.cobiaxusa.com (worldwide: cobiax.com)
Program Operator:	Labeling Sustainability
	11670 W Sunset Blvd.
	Los Angeles, CA 90049
	www.labelingsustainability.com
Product Category Rule:	ISO 21930:2017 Sustainability in buildings and civil engineering works Core rules for environmental product declarations of construction products and services and Sub Product Category Rule for Site Furnishings, CSI MasterFormat, Section 32 33 00
	PCR Program Operator: Labeling Sustainability
	PCR review was conducted by: Geoffrey Guest, Ph.D.
Independent LCA Reviewer and EPD Verifier:	This declaration was independently verified in accordance with ISO 14025:2006.
	Independent verification of the declaration, according to ISO 14025:2006
	Internal ☐ ; External ☐ X
	Third Party Verifier
	Geoffrey Guest, Certified 3rd Party Verifier under the Labeling Sustainability Program (www.labelingsustainability.com), CSA Group (www.csaregistries.ca),
Date of Issue:	05 July 2023
Period of Validity:	5 years; valid until 04 July 2028
EPD Number:	7fc87d1e-53ab-450f-b998-73a76fdbc8dd

CobiaxUSA

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COMPANY DESCRIPTION

Cobiax technologies, designed to enhance construction methods by reducing the weight and thickness of slabs or spanning larger areas without compromising on weight. Despite conventional usage of reinforced concrete slabs in construction, Cobiax technology optimizes resource consumption by implementing innovative voided building techniques. This not only decreases the utilization of concrete but also maintains a biaxial load-distribution.

Originating in 2004, Cobiax technology has been intelligently designed for use in various formats. It can be fully precast, assembled on-site, or even integrated as a mix of both, as per your specific construction requirements. Cobiax's void formers, made of recycled plastic, are incorporated during the building process, either on-site or as industrially manufactured precast elements. These formers introduce voids in the cast ion place slab, guiding the concrete to settle into the correct static structure.

With an eye towards maximum resource conservation, Cobiax's high load-bearing slab construction significantly reduces concrete use while enabling larger spaces to be spanned at the same weight. To give you an idea of the efficiency of building with Cobiax, one truckload of preassembled Cobiax void formers effectively replaces seven truckloads of concrete, and one load of unassembled Cobiax components replaces an astounding 25 truckloads of concrete.

Ensuring absolute safety in construction design, Cobiax technology is backed by extensive research and is now an internationally recognized building method. We guarantee that construction companies, engineers, architects, and builders will enjoy the many benefits of Cobiax voided systems without any concerns about structural stability. Make the smart choice for your construction projects with Cobiax technology, where innovation meets efficiency.

Benefits of Cobiax Voids include:

1. Enhanced Construction Efficiency: Cobiax technologies offer an innovative approach to construction methods, significantly reducing the weight and thickness of slabs or enabling larger areas to be spanned without increasing weight.
2. Resource Optimization: Despite the traditional use of reinforced concrete slabs, Cobiax technology minimizes resource usage by employing intelligent voided building methods. This results in less concrete usage while introducing a biaxial load-bearing effect.
3. Versatile Application: Developed in 2004, Cobiax technology can be integrated in various formats. It allows for full precasting, on-site assembly, or a blend of both, catering to different construction requirements.
4. Revolutionary Void Formers: Cobiax's unique void formers, made of plastic, are incorporated during the building process. These formers maintain open voids in the concrete slab that will be cast later, guiding the concrete to form the correct static structure.
5. Maximum Resource Conservation: By delivering high load-bearing slab construction, Cobiax significantly reduces concrete use. This allows for larger spaces to be spanned at the same weight. For instance, one truckload of preassembled Cobiax void formers can replace seven truckloads of concrete, while one load of unassembled Cobiax components can replace up to 25 truckloads of concrete.

6. Assured Safety: Cobiax technology guarantees absolute safety in construction design. Backed by extensive research, it's an internationally recognized building method. This ensures that construction companies, engineers, architects, and builders can enjoy the many benefits of Cobiax voided systems without any risk to structural stability.

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, www.labelingsustainability.com . This level of study is in accordance with EPD Product Category Rule (PCR) for In-situ concrete slab with void forms published by ; 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 Cobiax USA Inc. 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 Cobiax USA Inc. 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 Cobiax USA Inc.'s license to operate in the community. The intended audience for this LCA report is Cobiax USA Inc.'s project owners, suppliers, 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

Cobiax technology replaces concrete with recycled lightweight (hollow) void formers. All conventional COBIAX slab systems were examined regarding their environmental impacts, use of resources, and output flows. Within the framework of an LCA study, it was established that the reference unit of volume in m^3 includes approximate results for all slab system thicknesses. The solid slab system forms the "worst-case scenario" and is therefore used for base case for the declaration.

The resulting savings of up to 35% in concrete from using the Cobiax voids positively affect the construction of the slab itself (e.g., less deflection, a larger span, or a thinner slab thickness) and the whole building structure. The internationally patented Cobiax CLS structural formers, which are also fully approved by the building authorities, feature a uniform base area of 23.62" x 23.62" and are made from 100% recycled plastic.

Cobiax technology uses recycled lightweight plastic void formers to replace the heavy concrete inside a slab where it is not required. The resulting savings of up to 35% in concrete and weight has a positive effect on the construction of the slab itself (e.g. less deflection, larger spans or thinner slab thickness) and hence on the whole building structure. According to Cobiax the density of concrete is 2400 kg/m^3. The density of reinforcement steel is taken as standard 7850 kg/m^3.

Table 1: **Materials composition comparison using Cobiax CLS void former to a solid reinforced concrete slab. (Per Cobiax density of concrete = 2400 kg/m^3)**

	Dimension	Unit	Quantity
Solid Slab Without Void Former: Slab thickness= 22cm			
Concrete C20/25 (kg)	M	kg	504
Concrete C20/25 (m^3)	V	m^3	0.21
Reinforcing steel (kg)	M	kg	27.3
Voided Slab: CLS-P-110 Slab thickness= 20cm			
Concrete C20/25 (kg)	M	kg	355
Concrete C20/25 (m^3)	V	m^3	0.1479167
Reinforcing steel (kg)	M	kg	25.44
Cobiax void former (kg) 100% recycled	M	kg	1.842
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 24cm			
Concrete C20/25 (kg)	M	kg	624
Concrete C20/25 (m^3)	V	m^3	0.26
Reinforcing steel (kg)	M	kg	33.8
With Void Former: CLS-P-130 Slab thickness= 22cm			
Concrete C20/25 (kg)	M	kg	441
Concrete C20/25 (m^3)	V	m^3	0.18375
Reinforcing steel (kg)	M	kg	31.94
Cobiax void former (kg) 100% recycled	M	kg	1.981
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 26cm			
Concrete C20/25 (kg)	M	kg	672

	Dimension	Unit	Quantity
Concrete C20/25 (m^3)	V	m^3	0.28
Reinforcing steel (kg)	M	kg	36.45
With Void Former: CLS-P-150 Slab thickness= 24cm			
Concrete C20/25 (kg)	M	kg	475
Concrete C20/25 (m^3)	V	m^3	0.1979167
Reinforcing steel (kg)	M	kg	34.6
Cobiax void former (kg) 100% recycled	M	kg	2.12
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 28cm			
Concrete C20/25 (kg)	M	kg	725
Concrete C20/25 (m^3)	V	m^3	0.3
Reinforcing steel (kg)	M	kg	39.1
With Void Former: CLS-P-170 Slab thickness= 26cm			
Concrete C20/25 (kg)	M	kg	510
Concrete C20/25 (m^3)	V	m^3	0.2125
Reinforcing steel (kg)	M	kg	36.75
Cobiax void former (kg) 100% recycled	M	kg	2.106
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 30cm			
Concrete C20/25 (kg)	M	kg	768
Concrete C20/25 (m^3)	V	m^3	0.32
Reinforcing steel (kg)	M	kg	42.25
With Void Former: CLS-P-190 Slab thickness= 28cm			
Concrete C20/25 (kg)	M	kg	541
Concrete C20/25 (m^3)	V	m^3	0.2254167

	Dimension	Unit	Quantity
Reinforcing steel (kg)	M	kg	39.9
Cobiax void former (kg) 100% recycled	M	kg	2.092
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 34cm			
Concrete C20/25 (kg)	M	kg	818
Concrete C20/25 (m^3)	V	m^3	0.34
Reinforcing steel (kg)	M	kg	44.4
With Void Former: CLS-P-210 Slab thickness= 32cm			
Concrete C20/25 (kg)	M	kg	580
Concrete C20/25 (m^3)	V	m^3	0.2416667
Reinforcing steel (kg)	M	kg	41.5
Cobiax void former (kg) 100% recycled	M	kg	2.273
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 36cm			
Concrete C20/25 (kg)	M	kg	900
Concrete C20/25 (m^3)	V	m^3	0.37
Reinforcing steel (kg)	M	kg	49.05
With Void Former: CLS-P-230 Slab thickness= 34cm			
Concrete C20/25 (kg)	M	kg	630
Concrete C20/25 (m^3)	V	m^3	0.2625
Reinforcing steel (kg)	M	kg	46.18
Cobiax void former (kg) 100% recycled	M	kg	2.454
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 38cm			
Concrete C20/25 (kg)	M	kg	984

	Dimension	Unit	Quantity
Concrete C20/25 (m^3)	V	m^3	0.41
Reinforcing steel (kg)	M	kg	53.7
With Void Former: CLS-P-250 Slab thickness= 36cm			
Concrete C20/25 (kg)	M	kg	692
Concrete C20/25 (m^3)	V	m^3	0.2883333
Reinforcing steel (kg)	M	kg	50.4
Cobiax void former (kg) 100% recycled	M	kg	2.534
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 40cm			
Concrete C20/25 (kg)	M	kg	1055
Concrete C20/25 (m^3)	V	m^3	0.43
Reinforcing steel (kg)	M	kg	57.8
With Void Former: CLS-P-270 Slab thickness= 38cm			
Concrete C20/25 (kg)	M	kg	745
Concrete C20/25 (m^3)	V	m^3	0.3104167
Reinforcing steel (kg)	M	kg	53.7
Cobiax void former (kg) 100% recycled	M	kg	2.52
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 42cm			
Concrete C20/25 (kg)	M	kg	1125
Concrete C20/25 (m^3)	V	m^3	0.46875
Reinforcing steel (kg)	M	kg	60.3
With Void Former: CLS-P-290 Slab thickness= 40cm			
Concrete C20/25 (kg)	M	kg	792
Concrete C20/25 (m^3)	V	m^3	0.33

	Dimension	Unit	Quantity
Reinforcing steel (kg)	M	kg	57
Cobiax void former (kg) 100% recycled	M	kg	2.701
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 46cm			
Concrete C20/25 (kg)	M	kg	1170
Concrete C20/25 (m^3)	V	m^3	0.487
Reinforcing steel (kg)	M	kg	62.95
With Void Former: CLS-P-310 Slab thickness= 44cm			
Concrete C20/25 (kg)	M	kg	820
Concrete C20/25 (m^3)	V	m^3	0.3416667
Reinforcing steel (kg)	M	kg	59.2
Cobiax void former (kg) 100% recycled	M	kg	2.817
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 48cm			
Concrete C20/25 (kg)	M	kg	1230
Concrete C20/25 (m^3)	V	m^3	0.5125
Reinforcing steel (kg)	M	kg	65.6
With Void Former: CLS-P-330 Slab thickness= 46cm			
Concrete C20/25 (kg)	M	kg	865
Concrete C20/25 (m^3)	V	m^3	0.3604167
Reinforcing steel (kg)	M	kg	61.8
Cobiax void former (kg) 100% recycled	M	kg	3.419
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 50cm			
Concrete C20/25 (kg)	M	kg	1310

	Dimension	Unit	Quantity
Concrete C20/25 (m^3)	V	m^3	0.5458333
Reinforcing steel (kg)	M	kg	68.95
With Void Former: CLS-P-350 Slab thickness= 48cm			
Concrete C20/25 (kg)	M	kg	920
Concrete C20/25 (m^3)	V	m^3	0.3833333
Reinforcing steel (kg)	M	kg	65.2
Cobiax void former (kg) 100% recycled	M	kg	2.948
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 53cm			
Concrete C20/25 (kg)	M	kg	1385
Concrete C20/25 (m^3)	V	m^3	0.5770833
Reinforcing steel (kg)	M	kg	72.3
With Void Former: CLS-P-370 Slab thickness= 50cm			
Concrete C20/25 (kg)	M	kg	971.8
Concrete C20/25 (m^3)	V	m^3	0.4049167
Reinforcing steel (kg)	M	kg	68.1
Cobiax void former (kg) 100% recycled	M	kg	3.433
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 56cm			
Concrete C20/25 (kg)	M	kg	1450
Concrete C20/25 (m^3)	V	m^3	0.6041667
Reinforcing steel (kg)	M	kg	75.6
With Void Former: CLS-P-390 Slab thickness= 52cm			
Concrete C20/25 (kg)	M	kg	1020
Concrete C20/25 (m^3)	V	m^3	0.425

	Dimension	Unit	Quantity
Reinforcing steel (kg)	M	kg	71.4
Cobiax void former (kg) 100% recycled	M	kg	3.419
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 58cm			
Concrete C20/25 (kg)	M	kg	1550
Concrete C20/25 (m^3)	V	m^3	0.6458333
Reinforcing steel (kg)	M	kg	79.1
With Void Former: CLS-P-410 Slab thickness= 56cm			
Concrete C20/25 (kg)	M	kg	1095
Concrete C20/25 (m^3)	V	m^3	0.45625
Reinforcing steel (kg)	M	kg	74.9
Cobiax void former (kg) 100% recycled	M	kg	3.6
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 65cm			
Concrete C20/25 (kg)	M	kg	1655
Concrete C20/25 (m^3)	V	m^3	0.6895833
Reinforcing steel (kg)	M	kg	85.428
With Void Former: CLS-P-470 Slab thickness= 62cm			
Concrete C20/25 (kg)	M	kg	1165
Concrete C20/25 (m^3)	V	m^3	0.4854167
Reinforcing steel (kg)	M	kg	80.8
Cobiax void former (kg) 100% recycled	M	kg	3.514
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 74cm			
Concrete C20/25 (kg)	M	kg	1790

	Dimension	Unit	Quantity
Concrete C20/25 (m^3)	V	m^3	0.7458333
Reinforcing steel (kg)	M	kg	92.26
With Void Former: CLS-P-530 Slab thickness= 70cm			
Concrete C20/25 (kg)	M	kg	1261
Concrete C20/25 (m^3)	V	m^3	0.5254167
Reinforcing steel (kg)	M	kg	87
Cobiax void former (kg) 100% recycled	M	kg	4.13
Omega steel bar (kg)	M	kg	0.76
Solid Slab Without Void Former: Slab thickness= 79cm			
Concrete C20/25 (kg)	M	kg	1995.616
Concrete C20/25 (m^3)	V	m^3	0.83
Reinforcing steel (kg)	M	kg	98.7182
With Void Former: CLS-P-590 Slab thickness= 76cm			
Concrete C20/25 (kg)	M	kg	1410
Concrete C20/25 (m^3)	V	m^3	0.5875
Reinforcing steel (kg)	M	kg	93.52
Cobiax void former (kg) 100% recycled	M	kg	4.746
Omega steel bar (kg)	M	kg	0.76

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.

IN-PLACE CONCRETE SLAB WITH VOID FORMS DESIGN SUMMARY

The following tables provide a list of the in-place concrete slab with void forms products considered in this EPD along with key performance parameters.

Slab with void

Table 2: **Declared products with slab with former considered in this environmental product declaration**.

Prod #	Unique name/ID	Product type	Unit	Density, dry kg/Unit	Height (cm)	Length (cm)	Width (cm)	Diameter (cm)
1	Cobiax CLS-P-110 with Slab thickness= 20cm	in-situ concrete slab	m^3	1,874	8	60	60	60
2	Cobiax CLS-P-130 with Slab thickness= 22cm	in-situ concrete slab	m^3	1,872	10	60	60	60
3	Cobiax CLS- P-150 with Slab thickness= 24cm	in-situ concrete slab	m^3	1,868	12	60	60	60
4	Cobiax CLS-P-170 with Slab thickness= 26cm	in-situ concrete slab	m^3	1,863	14	60	60	60
5	Cobiax CLS-P-190 with Slab thickness= 28cm	in-situ concrete slab	m^3	1,850	16	60	60	60
6	Cobiax CLS-P-210 with Slab thickness= 32cm	in-situ concrete slab	m^3	1,862	18	60	60	60
7	Cobiax CLS-P-230 with Slab thickness= 34cm	in-situ concrete slab	m^3	1,861	20	60	60	60
8	Cobiax CLS-P-250 with Slab thickness= 36cm	in-situ concrete slab	m^3	1,842	22	60	60	60
9	Cobiax CLS - P-270 with Slab thickness= 38cm	in-situ concrete slab	m^3	1,886	24	60	60	60
10	Cobiax CLS - P-290 with Slab thickness= 40cm	in-situ concrete slab	m^3	1,839	26	60	60	60
11	Cobiax CLS-P-310 with Slab thickness= 44cm	in-situ concrete slab	m^3	1,832	28	60	60	60
12	Cobiax CLS - P-330 with Slab thickness= 46cm	in-situ concrete slab	m^3	1,839	30	60	60	60
13	Cobiax CLS-P-350 with Slab thickness= 48cm	in-situ concrete slab	m^3	1,830	32	60	60	60
14	Cobiax CLS-P-370 with Slab thickness= 50cm	in-situ concrete slab	m^3	1,829	34	60	60	60

15	Cobiax CLS-P-390 with Slab thickness= 52cm	in-situ concrete slab	m³	1,832	36	60	60	60
16	Cobiax CLS-P-410 with Slab thickness= 56cm	in-situ concrete slab	m³	1,837	38	60	60	60
17	Cobiax CLS-P-470 with Slab thickness= 62cm	in-situ concrete slab	m³	1,828	44	60	60	60
18	Cobiax CLS-P-530 with Slab thickness= 70cm	in-situ concrete slab	m³	1,830	50	60	60	60
19	Cobiax CLS-P-590 with Slab thickness= 76cm	in-situ concrete slab	m³	1,834	56	60	60	60

Base solid slab

Table 3: **Declared products with base solid slab considered in this environmental product declaration**.

Prod#	Unique name/ID	Product type	Unit	Density, dry kg/Unit
20	Slab 22 cm	Concrete slab	m³	2,400.00
21	Slab 24 cm	Concrete slab	m³	2,400.00
22	Slab 26 cm	Concrete slab	m³	2,400.00
23	Slab 28 cm	Concrete slab	m³	2,400.00
24	Slab 30 cm	Concrete slab	m³	2,400.00
25	Slab 34 cm	Concrete slab	m³	2,400.00
26	Slab 36 cm	Concrete slab	m³	2,400.00
27	Slab 38 cm	Concrete slab	m³	2,400.00
28	Slab 40 cm	Concrete slab	m³	2,400.00
29	Slab 42 cm	Concrete slab	m³	2,400.00
30	Slab 46 cm	Concrete slab	m³	2,400.00
31	Slab 48 cm	Concrete slab	m³	2,400.00
32	Slab 50 cm	Concrete slab	m³	2,400.00
33	Slab 53 cm	Concrete slab	m³	2,400.00
34	Slab 56 cm	Concrete slab	m³	2,400.00
35	Slab 58 cm	Concrete slab	m³	2,400.00
36	Slab 65 cm	Concrete slab	m³	2,400.00
37	Slab 74 cm	Concrete slab	m³	2,400.00
38	Slab 79 cm	Concrete slab	m³	2,400.00

IN-PLACE CONCRETE SLAB WITH VOID FORMERS DESIGN COMPOSITION

The following figures provide mass breakdown (kg per functional unit) of the material composition of each in-situ concrete slab with void forms design considered.

Slab with former

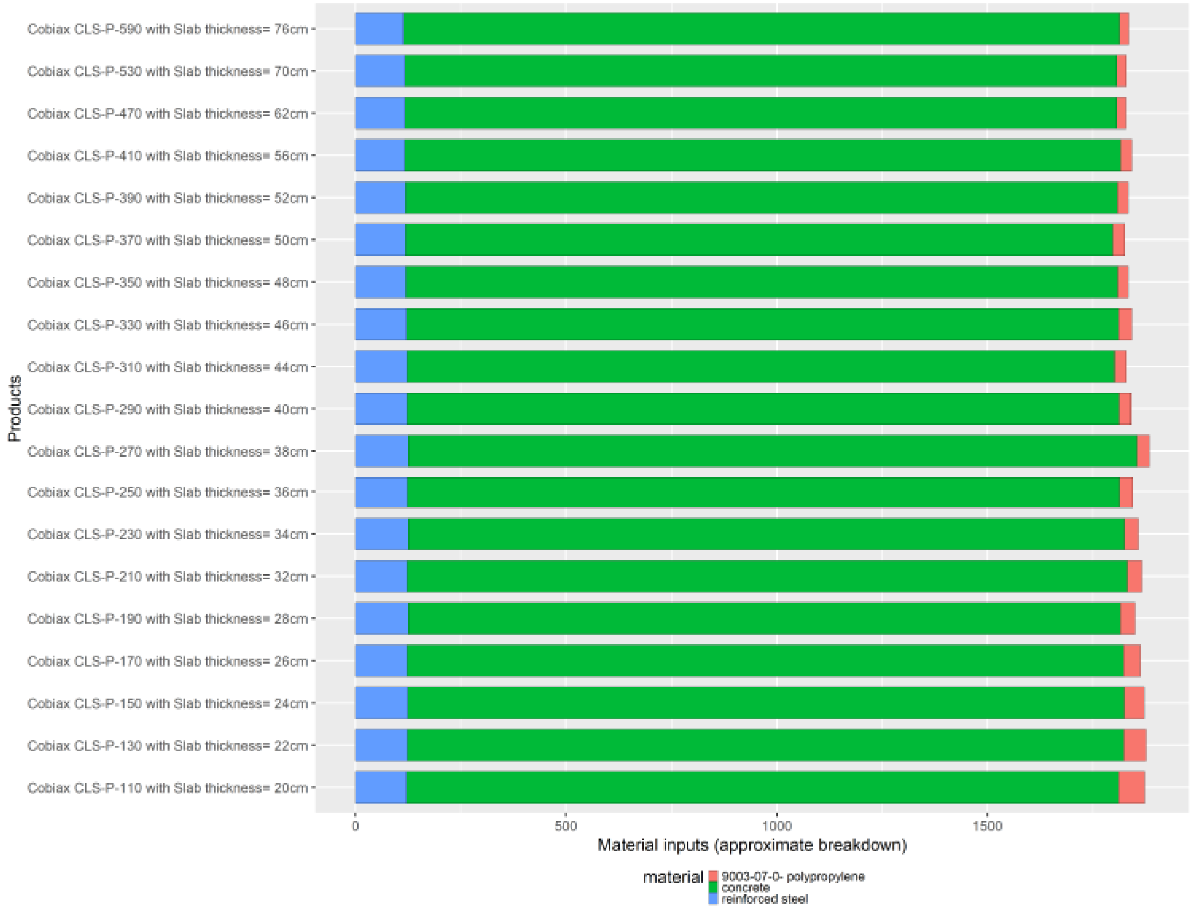

Figure 1: **Material composition - All declared products per 1m³ in-situ concrete slabs featuring Cobiax void former modules from the CLS range.**

Base solid slab

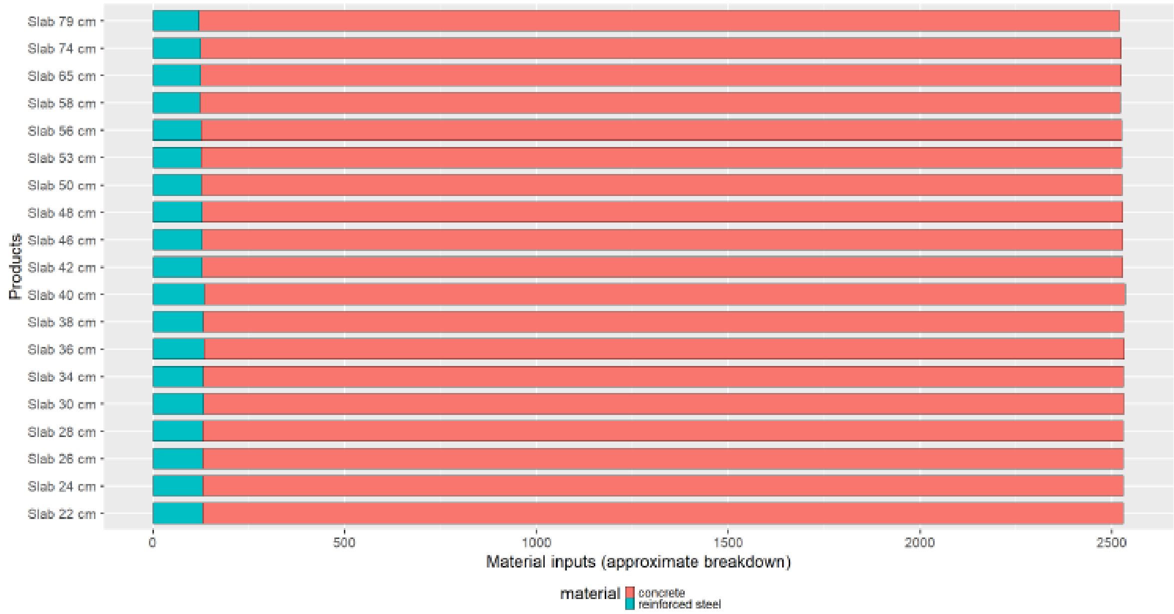

Figure 2: **Material composition - base slab per 1m³ in-situ concrete slabs featuring Cobiax void former modules from the CLS range.**

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 4: 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
Virgin-Polypropylene (Void)	polypropylene, granulate	100%	0%	0%	2%
Recycled Polypropylene (Void)	polypropylene, granulate	0%	100%	0%	0%

SYSTEM BOUNDARIES

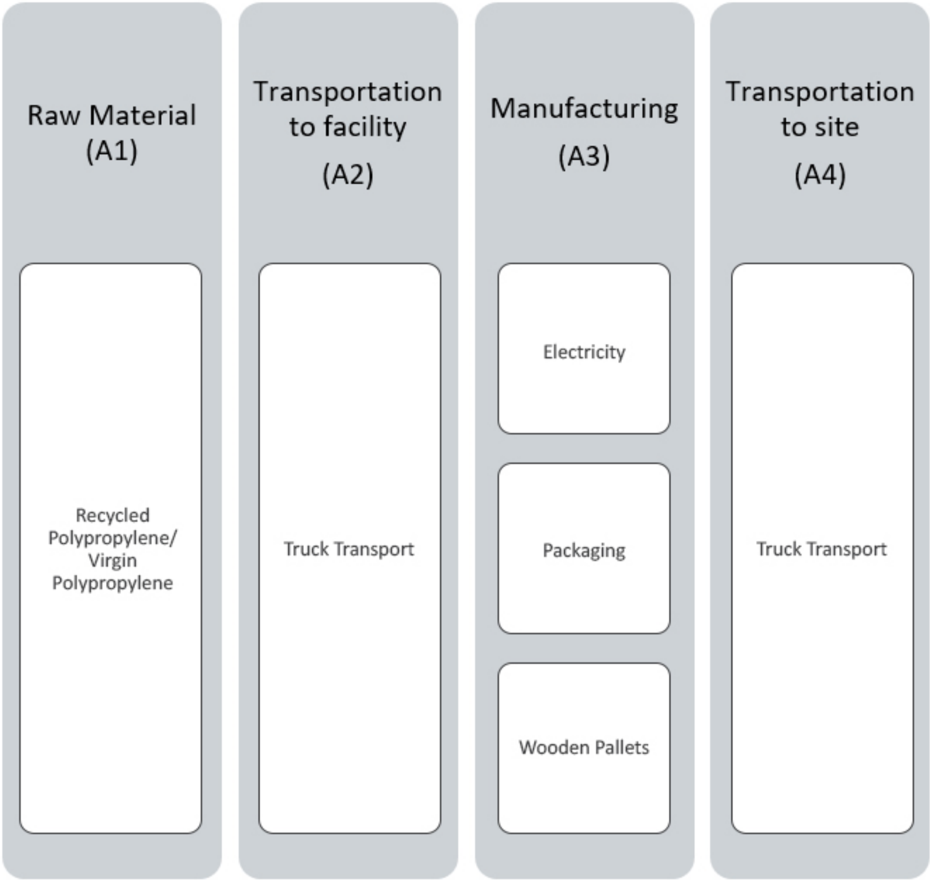

Figure 3: **The system boundaries for this study.**

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

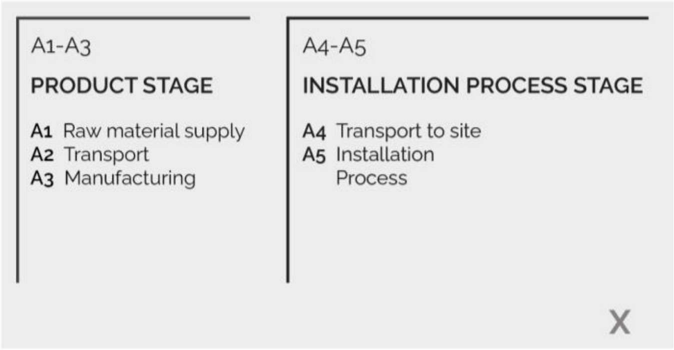

Figure 4: **General life cycle phases for consideration in a construction works system. (A5 is excluded)**

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.
- A4: Product plant gate-to-site of use logistics

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 Cobiax USA Inc., is located at their Cobiax USA facility in Dedham, MA. All operating data is formulated using the actual data from Cobiax USA Inc.’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 Cobiax USA Inc. 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.

No known flows are deliberately excluded from this EPD.

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

No recovered on-site energy occurs at this facility.

Table 5: **Reused or recycled components/materials at the A3 facility site**

Component/material for re-use/recycling	Value	Units	Re-used/recycled on-site or off-site
Pallets	5.88E+02	kg	Off-site
Plastic packaging	2.32E+00	kg	Off-site
polypropylene plastic	4.86E+05	kg	Off-site

The following statements explain how the above facility requirements/generation were derived:

Raw material transport: Raw materials, sourced from City of Pristina, for the void former is to the facility in Kosovo. The raw material is transported from the facility located in Pristina, Kosovo.

Electricity: According to Cobiax 0.2004 kwh of electricity is required for manufacturing one kg of re-granulate from recycled plastic which transfers to 4.615E-4 m^3 and 0.8667 kWh of electricity is required for manufacturing one kg void former from plastic granulates.

Process/space heating: The Cobiax does not have any other process or space heating.

Fuel required for machinery: On-site machinery for moving materials uses electricity therefore no additional fuel usage was reported.

Waste generation: Direct calculations for waste were not available for Cobiax CLS products. The receiving of Cobiax CLS products consists of the following: pallets and plastic wrap. According to Cobiax there are 22 bundles per container each with a pallet wrap in plastic packaging.

The waste calculations for the facility includes the plastic wrap used to wrap the pallet and a total of 49 kg plastic packaging waste is landfilled. No other waste is associated with the products.

Recovered energy: No on-site energy is recovered on site.

Recycled/reused material/components: According to the Advancing Sustainable Materials Management: 2018 Fact Sheet (US EPA), only <5% of the total plastic packaging is recycled in the USA. Similarly, about 95% of pallets are assumed to be recycled off-site at the end of their service life. The average transportation distance to the disposal point is considered as 50 km.

Module A1 material losses: Default material losses were used.

Direct A3 emissions accounting: There are no known direct site emissions.

A4 Product transport requirements: Cobiax product arrives at the job site by freight trucks with an average distance of 120 kilometers to the job site.

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 6: **LCI inputs assumed for module A1 (i.e., raw material supply)**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Pallets	market for EUR-flat pallet/EUR-flat pallet/RoW/unit	ecoinvent v3.8	Multiple Regions	v3.8 in 2021	1	3	1	3	3
Reinforcing Steel	market for reinforcing steel/reinforcing steel/GLO/kg	ecoinvent v3.8	Multiple Regions	v3.8 in 2021	2	3	2	3	3
Raw-propylene (Void)	polypropylene production, granulate/polypropylene, granulate/RoW/kg	ecoinvent v3.8	Pristina	v3.8 in 2021	1	3	2	3	3
Plastic Packaging	market for packaging film, low density polyethylene/packaging film, low density polyethylene/GLO/kg	ecoinvent v3.8	Multiple Regions	v3.8 in 2021	1	3	2	3	3
Concrete	market for concrete, 20MPa/concrete, 20MPa/RoW/m3	ecoinvent v3.8	Multiple Regions	v3.8 in 2021	2	A3	1	A3	A3
Recycled Polypropylene (Void)	Waste produced off-site	See A3 inputs	Pristina	See A3 inputs	2	A3	1	A3	A3

Table 7: **LCI inputs assumed for module A2 (i.e. transport of A1 inputs)**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Plastic Packaging-freight transport via Truck	market for transport, freight, lorry 7.5-16 metric ton, EURO4/transport, freight, lorry 7.5-16 metric ton, EURO4/RER/tkm	ecoinvent v3.8	RER	v3.8 in 2021	2	3	1	3	3

Raw-propylene (Void)-freight transport via Ship	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling/transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling/GLO/tkm	ecoinvent v3.8	GLO	v3.8 in 2021	2	3	1	3	3
Raw-propylene (Void)-freight transport via Truck	market for transport, freight, lorry 7.5-16 metric ton, EURO4/transport, freight, lorry 7.5-16 metric ton, EURO4/RER/tkm	ecoinvent v3.8	RER	v3.8 in 2021	2	3	1	3	3
Recycled Polypropylene (Void)-freight transport via Ship	transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling/transport, freight, lorry with refrigeration machine, 3.5-7.5 ton, EURO5, carbon dioxide, liquid refrigerant, cooling/GLO/tkm	ecoinvent v3.8	GLO	v3.8 in 2021	2	3	1	3	3
Recycled Polypropylene (Void)-freight transport via Truck	market for transport, freight, lorry 7.5-16 metric ton, EURO4/transport, freight, lorry 7.5-16 metric ton, EURO4/RER/tkm	ecoinvent v3.8	RER	v3.8 in 2021	2	3	1	3	3

Table 8: **LCI inputs assumed for module A3**

Input	LCI.activity	Data.source	Geo	Year	Technology	Time	Geography	Reliability	Completeness
Electricity	market for electricity, medium voltage, aluminium industry/electricity, medium voltage, aluminium industry/IAI Area, EU27 & EFTA/kWh	ecoinvent v3.8	Pristina	v3.8 in 2021	1	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 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 In-situ concrete slab with void forms 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 In-situ concrete slab with void forms 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 In-situ concrete slab with void forms 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 2022-01-01 to 2022-12-31.
- Upstream (background) LCI data was either the PCR specified default (if applicable) or more appropriate LCI datasets as found in the country-adjusted ecoinvent 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 (see tables below).

Table 10: **Life cycle impact categories and life cycle inventory metrics**

ID	LCIA.indicators	Abbreviations	Units
1	environmental impact: acidification	AP	moles of H+-Eq
2	environmental impact: eutrophication	EP	kg N
3	environmental impact: global warming	GWP	kg CO2-Eq
4	environmental impact: ozone depletion	ODP	kg CFC-11-Eq
5	environmental impact: photochemical oxidation	PCOP	kg NOx-Eq
6	material resources: metals/minerals: abiotic depletion potential (ADP): elements (ultimate reserves)	ADPe	kg Sb-Eq
7	energy resources: non-renewable: abiotic depletion potential (ADP): fossil fuels	ADPf	MJ, net calorific value
Inventory metrics			
8	Total primary energy	TPE	MJ-Eq

9	Renewable energy	RE	MJ-Eq
10	Non-renewable energy	NRE	MJ-Eq
11	Non-Renewable Resources	NRR	kg
12	Renewable Resources	RR	m^3
13	Water depletion: WDP	WDP	m^3
14	Land filling: bulk waste	LFW	kg waste
15	Land filling: hazardous waste	LFHW	kg waste

A summary description of each of the impact categories and inventory metrics is provided in the following table:

Table 11: **Definitions of life cycle impact categories and life cycle inventory metrics**

Midpoint impact categories	
Global Warming Potential (GWP) (units: kg CO2-eq)	Global Warming Potential or climate change can be defined as the change in global temperature caused by the greenhouse effect that the release of greenhouse gases by human activity creates. The Environmental Profiles characterization model is based on factors developed by the United Nations Intergovernmental Panel on Climate Change (IPCC). Factors are expressed as Global Warming Potential over the time horizon of different years, being the most common 100 years (GWP100), measured in the reference unit, kg CO2 equivalent.
Ozone Depletion Potential (ODP) (kg CFC-11-eq)	Ozone-depleting gases cause damage to stratospheric ozone or the ozone layer. CFCs, halons and HCFCs are the major causes of ozone depletion. The characterization model has been developed by the World Meteorological Organization (WMO) and defines the ozone depletion potential of different gases relative to the reference substance chlorofluorocarbon-11 (CFC-11), expressed in kg CFC-11 equivalent.
Acidification Potential (AP) (kg SO2-eq)	Acidic gases such as Sulphur dioxide (SO2) react with water in the atmosphere to form acid rain, a process known as acid deposition. Acidification potential is expressed using the reference unit, kg SO2 equivalent. The model does not take account of regional differences in terms of which areas are more or less susceptible to acidification. It accounts only for acidification caused by SO2 and NOx. This includes acidification due to fertilizer use, according to the method developed by the Intergovernmental Panel on Climate Change (IPCC). CML has based the characterization factor on the RAINS model developed by the University of Amsterdam.
Eutrophication Potential (EP) (PO4 3- -eq)	Eutrophication is the build-up of a concentration of chemical nutrients in an ecosystem which leads to abnormal productivity. This causes excessive plant growth like algae in rivers which causes severe reductions in water quality and animal populations. This category is based on the work of Heijungs, and is expressed using the reference unit, kg PO4 3- equivalents. Direct and indirect impacts of fertilizers are included in the method. The direct impacts are from production of the fertilizers and the indirect ones are calculated using the IPCC method to estimate emissions to water causing eutrophication.
Photochemical Ozone Creation/Smog Potential (POCP) (kg O3-eq)	Ozone is protective in the stratosphere, but on the ground-level, it is toxic to humans in high concentration. Photochemical ozone, also called ground-level ozone, is formed by the reaction of volatile organic compounds and nitrogen oxides in the presence of heat and sunlight. The impact category depends largely on the amounts of carbon monoxide (CO), Sulphur dioxide (SO2),

	nitrogen oxide (NO), ammonium and NMVOC (non-methane volatile organic compounds). Photochemical ozone creation potential (also known as summer smog) for emission of substances to air is calculated with the United Nations Economic Commission for 22 Europe (UNECE) trajectory model (including fate) and expressed using the reference unit, kg ethylene (C_2H_4) equivalent.
Abiotic Depletion Potential (ADPel and ADPff) (kg Sb-eq)	The main concern of this category is the health of humans and the ecosystem and how it is affected by the extraction of minerals and fossil fuels, which are inputs into the system. For each extraction of minerals and fossil fuels, the abiotic depletion factor is determined. This indicator is on a global scale and is based on the concentration reserves and rate of deaccumulation. The results are presented in units of the reference element strontium (i.e. Sb). For the purposes of this EPD, this impact category is split between mineral elements (i.e. ADPel) and fossil fuels (i.e. ADPff).
Inventory metrics	
Depletion of non-renewable material resources (NRM) (kg)	This indicator covers the cumulative life cycle consumption of non-renewable resources that are extracted from the ground but not including energy resources like coal, oil and natural gas. This indicator includes the consumption of metallic ores, aggregates, and other minerals. The units of measure are in terms of kilograms material extracted and utilized/wasted in the life cycle system considered.
Use of renewable material resources (RM) (kg)	This indicator covers the cumulative life cycle consumption of renewable resources that are extracted from nature like sustainably harvested biomass. The units of measure are in terms of kilograms material extracted and utilized/wasted in the life cycle system considered.
Depletion of non-renewable energy resources (NRE) (MJ HHV)	This indicator considers the cumulative life cycle consumption of non-renewable energy resources like oil, natural gas, and coal. The units of measure are in terms of Mega-Joules of energy resource extracted and utilized/wasted in the life cycle system considered.
Use of renewable primary energy (RE) (MJ HHV)	This indicator considers the cumulative life cycle extraction of renewable energy resources from nature like solar and wind energy as well as biomass for energy purposes. The units of measure are in terms of Mega-Joules of energy resource extracted and utilized/wasted in the life cycle system considered.
Total primary energy consumption (PEC) (MJ HHV)	This indicator is the summation of non-renewable and renewable energy extracted from nature, where the units of measure are in terms of Mega-Joules of energy resource extracted/utilized/wasted in the life cycle system considered.
Water Depletion Potential (WDP) (m^3)	This indicator considers the cumulative life cycle consumption of water required to produce the declared functional unit of a given product. The units of measure are in cubic meters of water consumed.

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.

- Renewable primary energy resources as energy (fuel);
- Renewable primary resources as material;
- Non-renewable primary resources as energy (fuel);
- Non-renewable primary resources as material;
- Secondary Materials;
- Renewable secondary fuels;

- Non-renewable secondary fuels;
- Recovered energy;
- Abiotic depletion potential for non-fossil mineral resources.
- Land use related impacts, for example on biodiversity and/or soil fertility;
- Toxicological aspects;
- Emissions from land use change [GWP 100 (land-use change)];
- Hazardous waste disposed;
- Non-hazardous waste disposed;
- High-level radioactive waste;
- Intermediate and low-level radioactive waste;
- Components for reuse;
- Materials for recycling;
- Materials for energy recovery;
- Recovered energy exported from the product system.

TOTAL IMPACT SUMMARY

The study identified four significant environmental impact hotspots in the life cycle analysis (LCA) of in-situ concrete slabs using Cobiax void former modules from the CLS range. These hotspots are from different modules, indicating a distribution of impact across different stages of production and disposal. First is module A1, Reinforcing Steel for the 1 m^3concrete slab, contributes 34% to 43% of the total impact. Therefore, sourcing lower-impact steel, such as recycled steel or steel manufactured through cleaner production processes, could be a potential mitigation strategy. Module A2, Recycled Polypropylene (Void), Freight Transport via ocean freight, represents the second significant impact, with an impact range of 15% to 30%. It suggests that the transportation of recycled polypropylene void formers contributes significantly to the overall environmental impact. Strategies to reduce this impact could include sourcing these materials closer to the project site to reduce transport distance or transitioning to more environmentally friendly transport methods. Next, Module A1, Concrete production (specifically the Portland Cement content) contributes the most significant impact, accounting for 22% to 31% of the total, including the impact from the Portland Cement. Therefore, concrete sourcing and production should be the primary focus of mitigation strategies. Using a concrete mix with a lower carbon footprint, such as mixes with higher proportions of supplementary cementitious materials (like fly ash or slag), can help reduce this impact. Focusing on these four areas makes it possible to significantly reduce the overall environmental impact of in-situ concrete slabs featuring Cobiax void former modules from the CLS range. It's essential to consider these impacts early in the design and planning stages of projects to maximize potential reductions.

The following table reports the total LCA results for each product produced at the given in-situ concrete slab with void forms facility on a per 1m^3 in-situ concrete slabs featuring Cobiax void former modules from the CLS range basis.

Voided Slab

Table 12: **Total life cycle (across modules in scope) impact results for the voided slab assuming the geometric mean point values on a per 1m^3 in-situ concrete slabs featuring Cobiax void former modules from the CLS range basis.**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	moles of H+-Eq	kg N	kg CO2-Eq	kg CFC-11-Eq	kg NOx-Eq	kg Sb-Eq	MJ, net calorific value
Minimum	94.1	0.116	442	3.11e-05	1.34	0.00282	4590
Maximum	119	0.147	559	3.94e-05	1.7	0.00358	5780
Mean	109	0.134	510	3.6e-05	1.55	0.00326	5320
Median	110	0.136	516	3.64e-05	1.57	0.00329	5380
Cobiax CLS- P-110 with Slab thickness= 20cm	115	0.139	527	3.75E-05	1.63	0.00335	5670
Cobiax CLS - P-130 with Slab thickness= 22cm	106	0.129	490	3.47E-05	1.51	0.00312	5230
Cobiax CLS -P-150 with Slab thickness= 24cm	114	0.139	527	3.73E-05	1.62	0.00336	5590
Cobiax CLS-P-170 with Slab thickness= 26cm	112	0.137	520	3.68E-05	1.59	0.00332	5480
Cobiax CLS -P-190 with Slab thickness= 28cm	112	0.137	523	3.68E-05	1.59	0.00333	5480
Cobiax CLS - P-210 with Slab thickness= 32cm	111	0.136	518	3.65E-05	1.58	0.00331	5410
Cobiax CLS-P-230 with Slab thickness= 34cm	112	0.138	524	3.69E-05	1.59	0.00334	5470
Cobiax CLS-P-250 with Slab thickness= 36cm	110	0.136	516	3.64E-05	1.57	0.00329	5380
Cobiax CLS-P-270 with Slab thickness= 38cm	111	0.137	520	3.66E-05	1.58	0.00332	5400
Cobiax CLS-P-290 with Slab thickness= 40cm	109	0.134	512	3.60E-05	1.55	0.00327	5310
Cobiax CLS-P-310 with Slab thickness= 44cm	94.1	0.116	442	3.11E-05	1.34	0.00282	4590
Cobiax CLS -P-330 with Slab thickness= 46cm	114	0.14	533	3.76E-05	1.62	0.00341	5550
Cobiax CLS -P-350 with Slab thickness= 48cm	107	0.132	505	3.55E-05	1.53	0.00323	5220

Cobiax CLS-P-370 with Slab thickness= 50cm	106	0.131	500	3.52E-05	1.52	0.0032	5180
Cobiax CLS -P-390 with Slab thickness= 52cm	119	0.147	559	3.94E-05	1.7	0.00358	5780
Cobiax CLS-P-410 with Slab thickness= 56cm	106	0.131	498	3.51E-05	1.51	0.00319	5140
Cobiax CLS -P-470 with Slab thickness= 62cm	108	0.134	509	3.58E-05	1.54	0.00326	5240
Cobiax CLS -P-530 with Slab thickness= 70cm	97.9	0.121	462	3.25E-05	1.4	0.00296	4750
Cobiax CLS-P-590 with Slab thickness= 76cm	108	0.133	508	3.58E-05	1.55	0.00326	5220

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m³**	**m³**	**kg waste**	**kg waste**
Minimum	5180	313	4860	293	0.00571	4.88	178	0.0226
Maximum	6540	472	6130	369	0.00716	6.27	226	0.0284
Mean	6010	377	5620	339	0.0066	5.66	205	0.0259
Median	6060	377	5670	344	0.00666	5.71	208	0.0263
Cobiax CLS-P-110 with Slab thickness= 20cm	6500	472	5990	351	0.00695	5.73	210	0.0263
Cobiax CLS-P-130 with Slab thickness= 22cm	5970	414	5510	328	0.0062	5.35	196	0.0246
Cobiax CLS-P-150 with Slab thickness= 24cm	6300	433	5920	352	0.0069	5.73	211	0.0266
Cobiax CLS-P-170 with Slab thickness= 26cm	6200	406	5790	347	0.00669	5.71	209	0.0263
Cobiax CLS-P-190 with Slab thickness= 28cm	6220	392	5780	351	0.0068	5.69	210	0.0267
Cobiax CLS-P-210 with Slab thickness= 32cm	6140	387	5710	344	0.00679	5.73	208	0.0263
Cobiax CLS- P-230 with Slab thickness= 34cm	6150	386	5780	347	0.00675	5.72	210	0.0267

Cobiax CLS-P-250 with Slab thickness= 36cm	6060	377	5670	344	0.00666	5.67	208	0.0263
Cobiax CLS-P-270 with Slab thickness= 38cm	6070	370	5680	345	0.00676	5.75	210	0.0265
Cobiax CLS-P-290 with Slab thickness= 40cm	6010	367	5610	343	0.00662	5.66	206	0.0261
Cobiax CLS-P-310 with Slab thickness= 44cm	5180	313	4860	293	0.00571	4.88	178	0.0226
Cobiax CLS - P-330 with Slab thickness= 46cm	6280	389	5870	357	0.00687	5.91	215	0.0271
Cobiax CLS-P-350 with Slab thickness= 48cm	5880	352	5500	335	0.00655	5.63	204	0.0257
Cobiax CLS-P-370 with Slab thickness= 50cm	5810	358	5470	331	0.00648	5.6	202	0.0253
Cobiax CLS - P-390 with Slab thickness= 52cm	6540	394	6130	369	0.00716	6.27	226	0.0284
Cobiax CLS-P-410 with Slab thickness= 56cm	5800	350	5450	328	0.00647	5.64	201	0.0251
Cobiax CLS-P-470 with Slab thickness= 62cm	5890	346	5540	333	0.00655	5.75	206	0.0258
Cobiax CLS-P-530 with Slab thickness= 70cm	5340	315	5000	304	0.00587	5.22	187	0.0234
Cobiax CLS-P-590 with Slab thickness= 76cm	5900	350	5520	333	0.00659	5.85	206	0.0255

Base solid slab

Table 13: **Total life cycle (across modules in scope) impact results for base slab, assuming the geometric mean point values on a per 1m³ in-situ concrete slabs featuring Cobiax void former modules from the CLS range basis.**

a) Midpoint Impact Categories:

Indicator/LCI Metric	AP	EP	GWP	ODP	PCOP	ADPe	ADPf
Unit	**moles of H+-Eq**	**kg N**	**kg CO2-Eq**	**kg CFC-11-Eq**	**kg NOx-Eq**	**kg Sb-Eq**	**MJ, net calorific value**
Minimum	119	0.151	576	4.07E-05	1.76	0.00378	5640
Maximum	128	0.161	614	4.33E-05	1.86	0.004	6070
Mean	124	0.157	598	4.22E-05	1.82	0.00391	5890

Median	125	0.157	602	4.24E-05	1.83	0.00392	5930
Slab 22 cm	125	0.158	603	4.25E-05	1.83	0.00394	5950
Slab 24 cm	125	0.158	603	4.25E-05	1.83	0.00394	5950
Slab 26 cm	125	0.158	604	4.26E-05	1.83	0.00394	5950
Slab 28 cm	125	0.158	604	4.26E-05	1.83	0.00394	5950
Slab 30 cm	126	0.159	608	4.29E-05	1.84	0.00396	6000
Slab 34 cm	126	0.158	605	4.26E-05	1.83	0.00394	5960
Slab 36 cm	127	0.159	610	4.29E-05	1.85	0.00397	6020
Slab 38 cm	126	0.158	606	4.27E-05	1.84	0.00395	5970
Slab 40 cm	128	0.161	614	4.33E-05	1.86	0.004	6070
Slab 42 cm	124	0.157	600	4.23E-05	1.82	0.00392	5910
Slab 46 cm	125	0.157	602	4.24E-05	1.83	0.00392	5930
Slab 48 cm	124	0.157	598	4.22E-05	1.82	0.00391	5890
Slab 50 cm	123	0.155	594	4.19E-05	1.81	0.00388	5840
Slab 53 cm	123	0.155	592	4.18E-05	1.8	0.00387	5820
Slab 56 cm	123	0.155	591	4.17E-05	1.8	0.00387	5810
Slab 58 cm	121	0.153	585	4.13E-05	1.78	0.00383	5740
Slab 65 cm	122	0.154	588	4.15E-05	1.79	0.00385	5780
Slab 74 cm	122	0.154	588	4.15E-05	1.79	0.00385	5770
Slab 79 cm	119	0.151	576	4.07E-05	1.76	0.00378	5640

b) Inventory Metrics:

Indicator/LCI Metric	**TPE**	**RE**	**NRE**	**NRR**	**RR**	**WDP**	**LFW**	**LFHW**
Unit	**MJ-Eq**	**MJ-Eq**	**MJ-Eq**	**kg**	**m³**	**m³**	**kg waste**	**kg waste**
Minimum	6300	311	5970	351	0.00752	7.65	239	0.0274
Maximum	6790	336	6420	384	0.00799	7.74	253	0.0301
Mean	6570	325	6240	370	0.00772	7.7	247	0.029
Median	6620	326	6270	373	0.00773	7.71	249	0.0292
Slab 22 cm	6620	328	6310	375	0.00786	7.72	249	0.0293
Slab 24 cm	6620	325	6310	372	0.00781	7.72	249	0.0293
Slab 26 cm	6620	329	6320	374	0.00774	7.72	249	0.0293
Slab 28 cm	6650	328	6330	376	0.00773	7.72	249	0.0294
Slab 30 cm	6730	331	6340	381	0.00787	7.73	251	0.0297
Slab 34 cm	6640	328	6260	377	0.00771	7.72	250	0.0294
Slab 36 cm	6730	334	6360	383	0.0079	7.73	252	0.0298
Slab 38 cm	6620	331	6320	377	0.00799	7.72	250	0.0295
Slab 40 cm	6790	336	6420	384	0.00779	7.74	253	0.0301
Slab 42 cm	6600	326	6270	372	0.00774	7.71	248	0.0291
Slab 46 cm	6620	327	6300	376	0.00777	7.71	249	0.0292
Slab 48 cm	6560	326	6270	373	0.00771	7.7	247	0.029
Slab 50 cm	6500	321	6210	366	0.00756	7.69	246	0.0287
Slab 53 cm	6480	322	6190	364	0.00764	7.69	245	0.0285
Slab 56 cm	6480	318	6160	363	0.00753	7.69	245	0.0285
Slab 58 cm	6410	316	6120	355	0.00752	7.67	242	0.028
Slab 65 cm	6450	318	6080	360	0.00762	7.68	244	0.0282
Slab 74 cm	6440	318	6100	360	0.00764	7.68	243	0.0282
Slab 79 cm	6300	311	5970	351	0.00755	7.65	239	0.0274

ADDITIONAL ENVIRONMENTAL INFO

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

REFERENCES

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:

- 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.
- US EPA (2020) Advancing Sustainable Materials Management: 2018 Fact Sheet, https://www.epa.gov/sites/production/files/2021-01/documents/2018_ff_fact_sheet_dec_2020_fnl_508.pdf