Environmental Product Declaration

In accordance with ISO 14025 and EN 15804

Ready-mix concrete

General Beton Romania

Programme:	The International EPD® System www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-01146
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Geographical scope:	Romania

1. Company

EPD Owner	GENERAL BETON ROMANIA
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Company identification information	Trade Register No: J35/1179/1997 Fiscal Registration Code: RO 9938922 Subscribed and paid-in capital: LEI 15.402.512,5
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Tonon Group

Tonon Group has been operating since 1955 in the general construction sector. Over the years it has developed its activities as a general construction company and manufacturer of building products such as concrete, bituminous conglomerates, membranes for waterproofing and acoustic insulation. Through the companies of the Group, it operates in the construction sector in different European and non-European countries. A range of products made in Italy is marketed all over the world.

All details on www.gruppotonon.it

General Beton Romania Srl

General Beton Romania is owned by Tonon Group. General Beton Romania set up the first concrete plant in Timisoara in 1998, an ecological station, a novelty for this area at that time. Two years later, based on an increase in investments in the western area of Romania, General Beton set up the second concrete plant in Romania in Arad. Nowadays it manages eight plants.

All details on www.generalbeton.ro

General Beton Romania started with the production of concrete for general purpose and subsequently completed its offer by producing mortars and special types of concrete, thus allowing all builders to manage their sites with high efficiency and economic sustainability. Concrete and mortar are created according to their purpose of use as well as through continuous interaction with professionals. The choice of raw materials and the characteristics of the concrete is made on the basis of cooperation between the technology department, the site manager and the customer, taking into account the specific conditions of the environment in which the concrete will be used. General Beton owns its certified technical laboratories, provided with the latest and most modern equipment, in order to offer viable solutions to customers for each phase of concrete production.

Right from the beginning, General Beton's main goal has been quality control, in order to provide the customer with a real guarantee of reliability of its products. Thanks to the high control level and process optimization and flexibility, the quality system of General Beton Romania has been certified SR EN ISO 9001:2015. Therefore General Beton ensures the constant checking of raw material quality, the development of competitive networks and the quality check of products before delivery. The company also cares about sustainable development; for this reason in its Romanian plants an environmental management system is maintained and continuously improved, in accordance with the standard SR EN ISO 14001:2015.

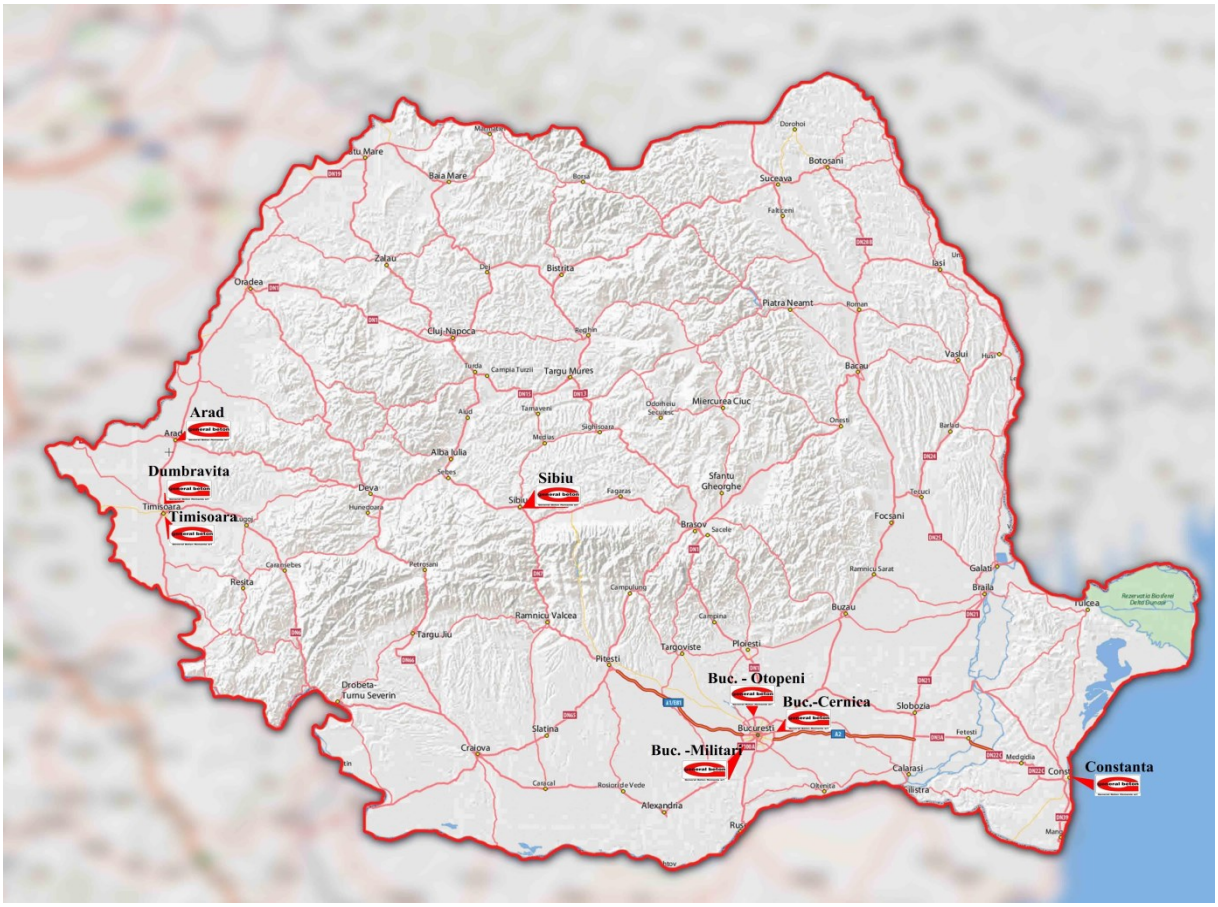
The ready-mix concrete is currently manufactured in the plants listed here below.

	Plant	Address
1.	**Bucuresti - Cernica**	**Drumul Intre Tarlale, 15A, Judet Ilfov, Cernica**
2.	**Bucuresti - Militari**	**Str. Preciziei, 64, Sector 6, zona Militari, Bucuresti**
3.	**Bucuresti - Otopeni**	**Str. Garii Otopeni, 4B, Judet Ilfov, Bucuresti**
4.	**Constanta**	**Zona CFR Palas, Constanta**
5.	**Timisoara - Sagului**	**Calea Sagului D.N. 59, km 9+500, Timisoara**
6.	**Timisoara - Dumbravita**	**Drum spre Covaci, Dumbravita, Judet Timis**
7.	**Arad**	**Calea Aurel Vlaicu nr. 259, Arad**
8.	**Sibiu**	**Sat Cristian, D.J. 106 B, Sibiu**

All these plants are fully owned and operated by General Beton Romania. The ready-mix concrete is manufactured according to the following standards and norms:

- EN 206:2013+A1:2016 Concrete - Part 1: Specification, performance, production and Conformity, transposed into Romanian Standard SR EN 206-1: 2014
- SR 13510:2006/C91:2008 (Romanian Standard): Concrete. Part 1: Specification, performance, production and conformity. National document for the application of SR EN 206-1
- CP NE 012/1-2007: Code of practice for the production of concrete, concrete and prefabricated concrete
- NE 014-2002: Normative for the execution of cement concrete pavements in fixed and in sliding formwork systems.

The plant layout and the manufacturing process are the same in every plant since the applied technologies and the working procedures of General Beton Romania are standardised and well consolidated. Therefore all the eight Romanian plants owned by General Beton Romania are involved in this LCA study.



2. Product

UN CPC code

375 *Concrete*

Product description

Our product: **Concrete**

Concrete should be defined as a material formed by mixing cement, coarse and fine aggregates and water, with or without the incorporation of admixtures, additions or fibres, which develops its properties by hydration.

Concrete conglomerate, like all stone materials, has good compressive strength, that is it behaves quite well when subjected to compression efforts. Concrete elements are usually casted with an embedded steel grid (that absorb flexural forces), and this composite material is notoriously indicated by the name of reinforced concrete.

Concrete has been present in our lives for centuries, so much that it is often considered a traditional material, not subject to innovations or changes. This is not true nowadays, since for more than forty years it has been subject to significant as continuous changes, so modern concrete can be fully considered part of high tech materials.

However, the market too often requires and uses standard low-grade concrete in the misguided belief that all product are the same. Fortunately, in the face of this still widespread belief, manufacturers continue to develop a wide range of products in terms of required performance and for several years technical institutions have regularly produced updates to standards for the classification of this material, trying to define its typologies and characteristics, thus providing all operators with precise directions for a proper use.

Use of **concrete**

Ready-mix concrete is manufactured in plastic state in the batching plant, and subsequently delivered on construction site by truck to create building elements (that could have structural or non-structural functions) or infrastructure elements (i.e. roads, bridges etc.).
The fluid consistency of the concrete is lost after a few hours. After a few days it assumes a resistance so that it can be released from the forms that determines its shape. For the expected mechanical performances it is defined to wait 28 days from casting.

At the end of life, concrete can be demolished by crushing. Demolished concrete is a non-hazardous inert waste. Concrete blocks can be subjected to a further recovery process consisting of grinding at different size for further uses, such as stabilized sublayer of constructions or roads or secondary raw material for the production of further concrete. Even in the case of reuse, concrete remains a non-hazardous material, as the tests carried out on leaching test confirm.

Technical specifications

Concrete, as the other building products, is subject to strict EC directives, due to its impacts on health, safety and environment. Concrete is subject to the Factory Production Control (FPC) instead of CE marking.

A specific concrete mix is usually defined by mechanical strength, exposure class, consistency and maximum diameter of aggregate.

The EPD is representative of all the different types of ready-mix concrete produced by General Beton Romania listed in table 2.1. These products are sold without a specific commercial name nor code, but identified by compressive strength class, environmental exposure class, slump class and type of cement. This characterisation is in accordance to SR EN 206-1: 2014.

	COMPRESSIVE / FLEXURAL STRENGTH CLASS	ENVIRONMENTAL EXPOSURE CLASS	CEMENT CONTENT RANGE (%)	DENSITY (kg/m^3)
CONCRETE FOR GENERAL PURPOSE	**C 8/10**	X0	**7÷8**	**2300**
			9÷10	
	C 12/15	X0	**9÷11**	
			11÷13	
	C 16/20	X0, XC1, XC2	**10÷12**	
			13÷14	
	C 20/25	XC1, XC2, XC3	**12÷15**	
			15÷17	
	C 25/30	XC1, XC2, XC3, XC4, XF1, XF2, XF3, XA1	**13÷15**	
			15÷17	
	C 30/37	XC4, XM2, XF2, XF4, XA1, XD1	**16÷18**	
	C 35/45	XC4, XD3, XM3, XS3, XF4, XA1	**18÷20**	
	C 40/50	XC4, XD3, XM3, XS3, XF4, XA1	**20÷21**	
ROAD CONCRETE	**BCR 3,5**	/	**16**	**2370**
	BCR 4,0	/	**16**	
	BCR 4,5	/	**16÷17**	
	BCR 5,0	/	**17**	

Table 2.1 - Products included in the EPD

Product manufacturing

Regarding the manufacturing process, an automatic system of feed screws, conveyor belts and pumps, operates the extraction from silos (for cement), hoppers (for aggregates) and tanks (for admixtures). Each component is loaded in an electronic scale until the set quantity is reached. The dosage (in weight or volume) of the correct amount of each raw material used in the recipe of a specific concrete type, is carried out through an electronic control panel, monitored by an operator. Subsequently, the mixing of the concrete is made in a pre-mix or directly into the truck.

A flow diagram for ready-mixed concrete process is displayed in the next figure.

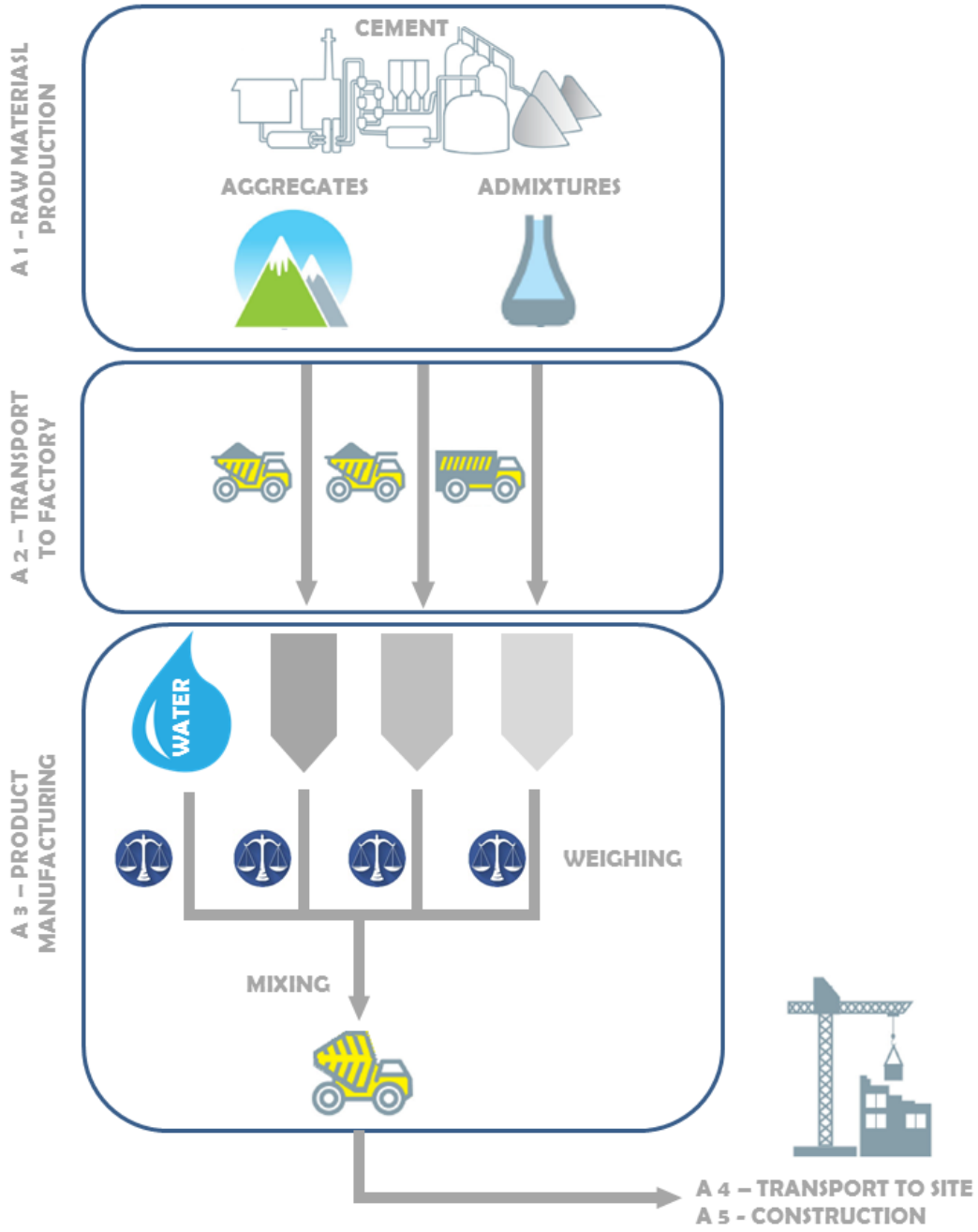


Fig. 2.1 – Ready-mix concrete manufacturing flow diagram

3. Content declaration

	COMPONENT	Cement	Gravel	Sand	Additives	Water
	UNIT	%	%	%	%	%
Compressive strenght class	C 8/10	7÷8	42÷45	40÷43	≤0,1	6,1÷7,8
		9÷10	42÷46	37÷42	≤0,1	6,5÷8
	C 12/15	9÷11	43÷52	31÷40	≤0,1	6,9÷7,5
		11÷13	43÷49	34÷38	≤0,1	7,2÷7,7
	C 16/20	10÷12	42÷52	30÷38	≤0,1	6,5÷7,6
		13÷14	40÷49	30÷38	≤0,1	7,1÷7,7
	C 20/25	12÷15	41÷50	29÷37	≤0,1	6,7÷7,8
		15÷17	39÷44	30÷36	≤0,2	7÷8,3
	C 25/30	13÷15	42÷50	29÷36	≤0,2	7÷7,7
		15÷17	41÷48	28÷35	≤0,2	7,1÷8,7
	C 30/37	16÷18	41÷51	26÷33	≤0,2	7,1÷8,6
	C 35/45	18÷20	42÷49	25÷31	≤0,4	7,5÷8,3
	C 40/50	20÷21	42÷49	23÷28	≤0,3	7,7÷8,5
	BCR 3,5	16	51	27	0,1	6,5÷6,6
	BCR 4,0	16	50	27	0,1	6,7÷6,8
	BCR 4,5	16÷17	50	27	0,1	6,8÷6,9
	BCR 5,0	17	50	27	0,2	6,4

Density has been declared in Table 2.1.

The products do not contain any substances that are listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorisation” by European Chemicals Agency.

4. Environmental performances assessment

4.1. Methodology

The Life Cycle Assessment (LCA) has been created in compliance with ISO 14040 and ISO 14044 standards, following a cradle-to-gate approach, considering all the environmental impacts starting from the extraction of the raw materials up to product ready for the delivery.

The study was conducted following the reference PCR for the product category PCR 2013:02, CONCRETE v.1.02, 2015-01-21

The software SimaPro v 8.3 and the Ecoinvent v3.3, database were used for the LCA model.

Declared unit

The declared unit is represented by 1 m^3 of ready-mix concrete with a given compressive strength class and environmental exposure class (concrete for general use) or with a given flexural strength class (road concrete) as defined in table 2.1.

Data related to the same concrete produced at different plants has been calculated using the weighted average based on their production.

System boundaries

Using terminology from EN 15804, the cradle to gate life cycle is broken down into three life cycle stages:

- A1, raw material extraction and processing, processing of secondary material input (e.g. recycling processes),
- A2, transport to the manufacturer,
- A3, manufacturing, including impacts from direct energy generation and waste disposal related to the manufacturing process.

The *Upstream Processes* (A1) include:

- Extraction and processing of raw materials (e.g. mining processes), biomass production and processing (e.g. agricultural or forestry operations) used as input for manufacturing the product;
- Extraction and processing of primary fuels used as input for manufacturing the product;
- Processing of secondary materials used as input for manufacturing the product, but not including those processes that are part of the waste processing in the previous product system until it reaches the end-of-waste state;
- Generation of electricity, steam and heat used in the product manufacturing process, which have been generated offsite, also including their extraction, refining and transport;
- Processing up to the end-of-waste state and disposal of any final residues produced during any process stage included in A1;
- Any transport of raw materials within the upstream supply chain, apart from the delivery of materials to the studied manufacturing process.

The *Core Processes (A2)* include:

- Transportation up to the factory gate and internal transport.

The product stage A2 includes all transport processes upstream and during the manufacturing process, but excluding transport of waste from the manufacturing process.

The *Core Processes (A3)* include:

- Production of ancillary materials or pre-products;
- Manufacturing of products and co-products, including the combustion of any primary fuels used in the manufacturing process;
- Processing up to the end-of-waste state or disposal of final residues including any packaging not leaving the factory gate with the product.

The Life Cycle Assessment follows a cradle-to-gate approach, excluding the transport to site, construction stage and end-of-life of the product.

Product stage			Construction		Use stage							End of life stage				Resource recovery stage
Raw materials	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
✓	✓	✓	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA

✓**:** Module Accounted For**. MNA:** Module Not Assessed.

Cut-off rules

The cut-off criteria applied in accordance with the reference PCR is based on the exclusion of the 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process.

The excluded flows are the packaging of the admixtures and some of the chemical substances in the admixtures composition since generic data for modelling were not available.

Allocation rules

Allocation methods applied in order to associate the elementary flows to the declared unit are based on physical relationships (mass criteria).

Data categories and sources

For the LCA study the following types of data were used:

Specific data: data related to the production processes of the ready-mix concrete at plant level. All the data refers to the year 2016. In particular, specific data refers to raw materials and maintenance materials quantities; energy and water consumption; waste production, etc.

Generic data: data taken from Ecoinvent v.3.3 database. It has been used for the extraction and processing of raw materials, for the production of admixtures, for the production of electricity and, in general, for all those processes in which the collection of specific data was not possible.

Proxy data: data coming from estimates based on similar processes, whose data is known from the literature. This type of data has been used when specific or generic data was not available. The environmental impacts associated to proxy data do not exceed 10% of the overall environmental impact from the product system.

Regarding electricity production in Romania, data coming from electricity mixes of Ecoinvent 3.3 database were considered.

4.2. Use of resources

Here below are the results about the use of resources. The data are related to the production of 1 m^3 of ready-mix concrete. Module A1, A2, A3 are declared as one aggregated module A1-3.

	Use of resources	Non-renewable, as energy	Non-renewable, as raw materials	Non-renewable, TOTAL	Renewable, as energy	Renewable, as raw materials	Renewable, TOTAL	Use of secondary material	Use of net fresh water
Strength class	Unit / Cement	MJ	MJ	MJ	MJ	MJ	MJ	kg	m^3
C 8/10	7÷8 %	1037,89	0,00	**1037,89**	55,54	0,00	**55,54**	12,45	2,37
	9÷10 %	1213,83	0,00	**1213,83**	65,06	0,00	**65,06**	15,92	2,40
C 12/15	9÷11 %	1265,88	0,00	**1265,88**	68,31	0,00	**68,31**	16,84	2,31
	11÷13 %	1434,34	0,00	**1434,34**	77,19	0,00	**77,19**	20,32	2,44
C 16/20	10÷12 %	1366,34	0,00	**1366,34**	74,43	0,00	**74,43**	19,22	2,34
	13÷14 %	1540,18	0,00	**1540,18**	83,42	0,00	**83,42**	22,69	2,47
C 20/25	12÷15 %	1553,28	0,00	**1553,28**	84,22	0,00	**84,22**	22,69	2,39
	15÷17 %	1765,28	0,00	**1765,28**	95,94	0,00	**95,94**	27,27	2,51
C 25/30	13÷15 %	1623,17	0,00	**1623,17**	87,92	0,00	**87,92**	23,98	2,40
	15÷17 %	1793,57	0,00	**1793,57**	97,15	0,00	**97,15**	27,64	2,53
C 30/37	16÷18 %	1858,15	0,00	**1858,15**	100,79	0,00	**100,79**	28,55	2,45
C 35/45	18÷20 %	2099,90	0,00	**2099,90**	112,14	0,00	**112,14**	32,39	2,56
C 40/50	20÷21 %	2181,71	0,00	**2181,71**	118,41	0,00	**118,41**	34,77	2,50
BCR 3,5	16 %	2007,48	0,00	**2007,48**	108,49	0,00	**108,49**	27,09	2,54
BCR 4	16 %	2047,78	0,00	**2047,78**	110,69	0,00	**110,69**	27,82	2,55
BCR 4,5	16÷17 %	2096,75	0,00	**2096,75**	113,49	0,00	**113,49**	28,77	2,57
BCR 5,0	17 %	2202,99	0,00	**2202,99**	118,14	0,00	**118,14**	30,02	2,63

4.3. Potential environmental impact

Here below are the environmental profiles of the products. The data are related to the production of 1 m^3 of ready-mix concrete. Module A1, A2, A3 are declared as one aggregated module A1-3.

Results have been presented for every single compressive/flexural strength class and different cement content range, by using representative average recipes. According with the latest version of General Programme Instructions, environmental impacts related to all the recipes (catalogue products) belonging to the same cement content range are included in a variation range of ±10% with respect to the defined average recipe results.

The latest baseline characterisation factors of CML method, whose validity is in Europe, have been used.

	Impact category	Acidification	Eutrophication	Global warming (GWP100a)	Photochemical oxidation	Ozone layer depletion	Abiotic depletion	Abiotic depletion, fossil fuels
Strength class	Unit / Cement	kg SO_2 eq	kg PO_4^{---} eq	kg CO_2 eq	kg C_2H_4 eq	kg CFC-11 eq	kg Sb eq	MJ
C 8/10	7÷8 %	0,43	0,13	164,40	0,02	7,40E-06	1,88E-04	940,01
	9÷10 %	0,50	0,15	202,34	0,02	8,42E-06	2,03E-04	1098,44
C 12/15	9÷11 %	0,52	0,16	212,89	0,02	8,72E-06	2,14E-04	1144,84
	11÷13 %	0,60	0,18	250,31	0,02	9,72E-06	2,23E-04	1296,78
C 16/20	10÷12 %	0,57	0,17	238,04	0,02	9,35E-06	2,20E-04	1234,28
	13÷14 %	0,65	0,20	275,69	0,03	1,04E-05	2,31E-04	1391,32
C 20/25	12÷15 %	0,65	0,20	276,51	0,03	1,04E-05	2,37E-04	1403,16
	15÷17 %	0,75	0,23	325,44	0,03	1,17E-05	2,50E-04	1593,56
C 25/30	13÷15 %	0,68	0,21	290,76	0,03	1,08E-05	2,44E-04	1466,26
	15÷17 %	0,75	0,23	329,87	0,03	1,19E-05	2,53E-04	1619,54
C 30/37	16÷18 %	0,78	0,24	341,05	0,03	1,22E-05	2,66E-04	1677,77
C 35/45	18÷20 %	0,87	0,26	384,99	0,03	1,35E-05	2,90E-04	1898,14
C 40/50	20÷21 %	0,92	0,28	409,60	0,04	1,41E-05	2,98E-04	1969,15
BCR 3,5	16 %	0,86	0,25	382,40	0,03	1,34E-05	2,78E-04	1816,69
BCR 4	16 %	0,88	0,26	391,78	0,03	1,36E-05	2,80E-04	1853,03
BCR 4,5	16÷17 %	0,90	0,26	403,84	0,03	1,39E-05	2,83E-04	1897,01
BCR 5,0	17 %	0,94	0,27	421,52	0,04	1,45E-05	2,95E-04	1994,62

4.4. Waste production

Here below are the results about the waste production. The data are related to the production of 1 m^3 of ready-mix concrete. Module A1, A2, A3 are declared as one aggregated module A1-3.

	Waste type	Hazardous waste	Non-hazardous waste	Radioactive waste
Strength class	Unit / Cement	kg	kg	kg
C 8/10	7÷8 %	1,38E-02	57,47	5,23E-03
	9÷10 %	1,39E-02	57,51	6,00E-03
C 12/15	9÷11 %	1,39E-02	57,61	6,22E-03
	11÷13 %	1,40E-02	57,72	6,98E-03
C 16/20	10÷12 %	1,39E-02	57,67	6,73E-03
	13÷14 %	1,40E-02	57,76	7,49E-03
C 20/25	12÷15 %	1,40E-02	57,85	7,52E-03
	15÷17 %	1,41E-02	57,93	8,50E-03
C 25/30	13÷15 %	1,41E-02	57,94	7,81E-03
	15÷17 %	1,41E-02	58,00	8,60E-03
C 30/37	16÷18 %	1,42E-02	58,27	8,85E-03
C 35/45	18÷20 %	1,42E-02	58,61	9,76E-03
C 40/50	20÷21 %	1,43E-02	58,66	1,03E-02
BCR 3,5	16 %	1,42E-02	59,24	9,55E-03
BCR 4	16 %	1,43E-02	59,25	9,73E-03
BCR 4,5	16÷17 %	1,43E-02	59,26	9,96E-03
BCR 5,0	17 %	1,43E-02	59,58	1,03E-02

Other material flows (PCR, table 6, paragraph 4.2.3) are missing for the studied system.

5. Programme-related information and verification

Programme	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com
EPD registration number	S-P-01146
Published	2017-11-28
Valid until	2022-11-08
Revision date	2017-09-26
Product Category Rules	PCR 2013:02, CONCRETE v. 1.02, 2015-01-21
Product group classification	UN CPC 375
Reference year for data	2016
Geographical scope	Romania

CEN standard EN 15804 served as the core PCR The PCR 2013:02 for UN CPC 375 serves as the specific PCR for this EPD Product Category Rules (PCR) review was conducted by the Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com.
Independent verification of the declaration, according to ISO 14025:2006: ☐ internal x external
Independent Verifier: SGS Italia S.p.A. via Caldera, 21 20153 - Milano Tel. +39 02.73931 - Fax +39 02.70124630 www.it.sgs.com **Accredited or approved by:** Accredia, certificate n.006H

EPD of construction products may not be comparable if they do not comply with the requirements of comparability set in EN 15804.

EPDs within the same product category but from different programmes may not be comparable.

EPD only covers the Cradle to Gate stage because other stages are very dependent on particular scenarios and are better developed for specific building or construction works.

Contacts

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Programme operator	EPD International AB info@environdec.com

6. References

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