EPD of Ready-Mix Concrete

ISO 14020:2000, IS0 14025:2006, ISO 14040:2006, ISO 21930:2007, EN 15804:2012, UN CPC 375:2013, UN CPC 3744: 2013

Romania
Edition 1, Revision 0: January 2014

Content

Environmental Product Declaration (EPD) of Ready-Mix Concrete

1. Aim and Scope

The current document is developed for providing a measurable and verifiable input for the environmental assessment of construction works done with the ready-mix concrete manufactured and delivered from the locations fully owned and operated by Holcim in Romania.

The company currently offers to its customers ready-mix concrete made in environmentally-friendly plants designed and built based on the latest technologies, which allow the achievement of superior performance in terms of productivity, controlled and consistent quality, occupational health & safety, environmental standards.

Figure 1: RMX Plant, Holcim, Romania

The declaration is established for the average product of these manufacturing plants. The average is based on the weighted average production volume of each plant. As the applications of ready-mix concrete as an intermediate material are numerous, a unique functional unit cannot be defined and therefore this EPD is based on a declared unit = 1 m^3 of ready-mix concrete.

2. General information

2.1 EPD, LCA, PCR information

EPD Information		
Program operator	The international EPD System	The International EPD System Vasagatan 15-17 SE-111 20 Stockholm Sweden Email: info@environdec.com Web: www.environdec.com
Declaration holder	Holcim Romania	Address: 169 A Calea Floreasca Street Building B, Floor 7, Sector 1, RO 014459, Bucharest, Romania Phone: +4021.231.77.08/09 Fax +4021.231.77.14/15 Contact person: Mihaela Odangiu Email: Mihaela.Odangiu@holcim.com Mobile: +40742.358.943 Web: www.holcim.ro Company identification information: Trade Register No: J40/399/2002 Fiscal Registration Code: RO 12253732 Subscribed and paid-in capital: LEI 205,268,05
Product	Ready-Mix Concrete	
Declaration number	S-P-00526	
Date of Issue:	2014-04-01	
Period of Validity:	2019-04-01	
Reference standards:	IS0 14020:2000, ISO 14025:2006	

Table 1: EPD Information

Reference PCR	The International EPD System: UN CPC 375 Concrete 2013:02 Version 1.0
Date of issue	2013-02-12
Valid until	2018-02-12
Appointed PCR moderator	Jane Anderson, PE International, j.anderson@pe-international.com
Independent verification of the EPD	External, according to ISO 14025
Third party verifier	Carl Otto Nevén Independent verifier approved by the International EPD System

Table 2: PCR information

LCA Information	
Title	Life Cycle Assessment of ready-mix concrete production of Holcim Romania 1 m^3 average ready-mix concrete
Date of Issue:	2014-04-01
Preparer:	Ingenieurbüro Trinius GmbH Barmbeker Str. 9A. 22303 Hamburg, Germany Phone: +49 40 2841 788 00 Fax +49 40 2841 788 29 Contact person: Wolfram Trinius Email: trinius@trinius.de
Reference standards:	ISO 14040:2006, ISO 14044:2006, EN 15804:2012

Table 3: LCA Information

2.2 Reference period of EPD data

The reference period for the data used within this EPD is the year 2012.

2.3 Geographical scope of EPD application

The geographical scope of this EPD is international.

2.4 Additional information about EPD

This EPD provides information concerning the production of ready-mix concrete only. This information can be used as an input for an assessment of a specific application of ready-mix concrete with regard to its entire life cycle, which also takes into account the beneficial contribution of ready-mix concrete to construction.

The production of ready-mix concrete is subject to Romanian and European legislation, which addresses all relevant environmental effects like the excavation of natural raw materials, the rehabilitation of quarries, the recovery of energy and material from wastes and the emission of noise, dust and hazardous substances (NO_x, SO_2, heavy metals, etc.).

The ready-mix concrete addressed in this EPD is manufactured in the locations fully owned and operated by Holcim in Romania, according to the following standards and norms:

- European Norm: EN 206-1:2000 Concrete - Part 1: Specification, performance, production and Conformity, transposed into Romanian Standard SR EN 206-1:2002/A1:2005/A2:2005/C91:2008;
- Romanian Standard SR 13510:2006/C91:2008: Concrete. Part 1: Specification, performance, production and conformity. National document for the application of SR EN 206-1
- CP 012/1-2007: Code of practice for the production of concrete

- NE 014:02: Normative for the execution of cement concrete pavements in fixed and in sliding formwork systems

The commercial applications of our ready-mix concrete covers a wide range: from foundation, flooring, car parking, access roads, terracing, frames, stairs, lift shafts, to major infrastructure works, hydro-technical constructions, etc.

3. Product description and system boundaries

3.1 Product identification and usage

Concrete is a composite material obtained through the homogenization of cement, aggregates, water and additives.

Holcim produces in Romania this mix in environmentally -friendly, automated and high performing plants and delivers it to the construction site.

Sustainable development
In order to respect the principles of sustainable development, HOLCIM implements, maintains and continuously improves the integrated management system, in accordance with the applicable reference documentation: SR EN ISO 9001:2008, SR EN ISO 14001:2005, SR OHSAS 18001:2008, BES 6001: 2009.

This EPD covers all types of Ready-Mix Concrete (RMX) produced by Holcim in Romania with care for sustainable development principles, as presented in the table below.

Plant	Standards/ Norms	Ready-mix concrete type	
		Concrete for general use	Road concrete
RMX Chitila	SR EN 206-1:2002/ A1:2005/A2:2005/ C91:2008; SR 13510:2006/ C91:2008; CP 012/1-2007; NE 014:02.	C8/10; C12/15; C16/20;C20/25; C25/30; C30/37;C35/45; C40/50; C50/60	BcR 3,5; BcR 4; BcR 4,5
RMX Pipera		C8/10;C12/15;C16/20;C20/25; C25/30;C30/37;C35/45;C40/50; C45/55;C50/60	BcR 3,5; BcR 4; BcR 4,5; BcR 5
RMX Clinceni		C8/10;C12/15;C16/20;C20/25; C25/30;C30/37; C40/50;C50/60	BcR 3,5; BcR 4; BcR 4,5
RMX Pantelimon		C8/10;C12/15;C16/20;C20/25; C25/30;C30/37;C35/45;C40/50; C45/55;C50/60	BcR 3,5; BcR 4; BcR 4,5
RMX Craiova		C8/10;C12/15;C16/20; C20/25; C25/30;C30/37; C35/45	BcR 3,5; BcR 4; BcR 4,5
RMX Ploiesti		C8/10;C12/15;C16/20; C20/25;C25/30;C30/37; C35/45	BcR 3,5; BcR 4; BcR 4,5
RMX Cluj		C8/10;C12/15;C16/20;C20/25; C25/30;C30/37; C35/45; C40/50;C45/55	BcR3.5; BcR4; BcR4.5; BcR5
RMX Timisoara		C8/10;C12/15;C16/20; C20/25; C25/30;C30/37; C35/45	BcR3.5; BcR4
RMX Oradea		C8/10;C12/15;C16/20; C20/25;C25/30;C30/37; C35/45	BcR 3,5; BcR 4; BcR 4,5
RMX Sibiu		C8/10;C12/15;C16/20; C20/25; C25/30;C30/37; C35/45	BcR 4 ; BcR 4,5
RMX Tg.Mures		C8/10;C12/15;C16/20; C20/25; C25/30;C30/37; C35/45;C40/50	BcR 4; BcR 4,5; BcR5
RMX Brasov		C8/10;C12/15;C16/20;C20/25; C25/30;C30/37; C35/45;C40/50; C45/55;C 50/60	BcR3,5; BcR 4; BcR 4,5; BcR 5
RMX	SR EN 206-1:2002/	C8/10;C12/15;C16/20; C20/25;	n/a

Satu Mare	A1:2005/A2:2005/ C91:2008; SR 13510:2006/ C91:2008; CP 012/1-2007.	C25/30;C30/37; C35/45	

Table 4: Types of ready-mix concrete produced by Holcim in Romania

3.2 Product manufacturing

The main steps in ready-mix concrete production process are:

- Raw material supply and storage
- Raw material preparation
- Mixing

as illustrated in the figure presented below:

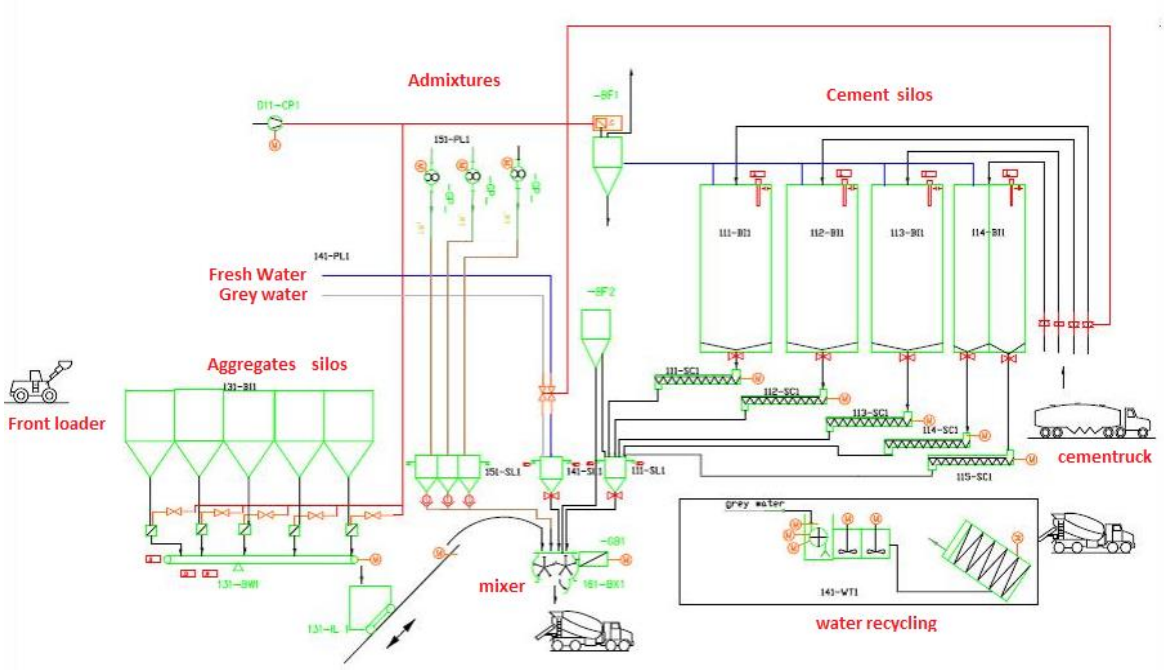

Figure 2: Ready mix-concrete production flow, Holcim, Romania

The water recycling system from Holcim plants allows separation of water and aggregates (resulted from the return of fresh concrete and from the washing of ready-mix trucks) for further re-utilization within the production process.

3.2.1 Raw material preparation

The process flow of production of cement and aggregates is communicated in separate EPDs. See EPD S-P-00527 for average grey cements and S-P-00528 for aggregates.

3.2.2 Mixing

The ingredients are blended in a mechanical mixer. Energy for the concrete production is supplied by diesel fuel and electricity.

3.3 System boundaries

The system boundaries are cradle to gate as shown in the figure below:

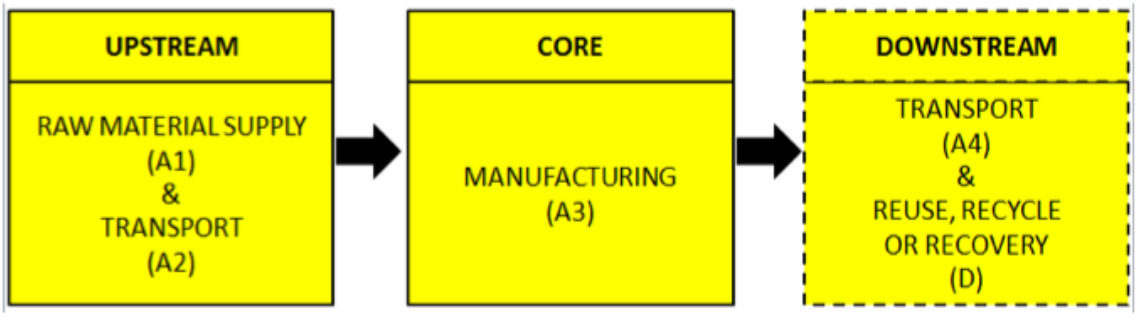

Figure 3: Illustration of the life cycle structure and rough system boundaries

Squares with unbroken edge line indicate processes that shall be included, dashed edge line indicate processes that are option (Figure and explanatory line copied without change from UN CPC 3744)

This EPD is established for the modules A1, A2 and A3.

4. LCA

4.1 Information sources and data quality

All core data required for this EPD has been collected from the HOLCIM plants for the year 2012. Company and production specific data is applied in the foreground system of the LCA.
The foreground data has been collected on site and validated based on mass balances. Data collection was performed iteratively to ensure high quality of data. Background data applied in the LCA has been obtained from the GaBi6 database. Electricity was considered applying data for the Romanian electricity mix.

4.2 Estimations and methodology

4.2.1 Allocation Procedures

All allocation is performed according to the PCR. As no co-products are produced, the flow of materials and energy and also the associated release of substances and energy into the environment is related exclusively to the concrete produced.

All data is included based on measured data for each plant. To ensure high representativeness for calculation of the average concrete, this specific data has been weighted based on the accounted production volume of each plant.

4.2.2 Average concrete

The inventory data of the different cements produced at the Holcim Romania plants is used to calculate the declared average concrete. The average is determined based on the produced amounts by weight in 2012.

4.2.3 Declared unit

The declared unit for the EPD is 1 m^3 average ready-mix concrete leaving the factory gate. EPDs for the constituent products cement and aggregates are also available, these are declared per kg. (EPD S-P-00527 Holcim grey cements) (EPD S-P-00528 Holcim aggregates).

4.2.4 Impact Assessment

The impact assessment is carried out applying the established CML method (Guinée et al, 2001). The applied categories and characterization factors within GaBi6 are provided in the CML version published in November 2010. Additionally, selected results from the inventory analysis are displayed. The selection of displayed indicators follows the provisions in the PCR document.

4.3 Cut-off rules

For the foreground process of RMX production no cut-off is necessary. However a significant contribution to the overall environmental impacts comes from the production of cement. Therefore the cut-off used in the calculation for the cement, according to the PCR UN CPC 3744 (The International EPD System), is continued in its effects in the production of concrete.

For transparency reasons the information from the cement EPD S-P-00527 is included within this EPD for concrete.

The PCR on cement states that the production of granulated blast furnace slag (GBFS) and fly ash can be excluded from the analysis when the origin of the materials is from Europe. When specific production data for materials that contribute less than 1% to a module are not available and those materials are not expected to have a major environmental impact, those materials can be excluded from the study. Table 1 lists the materials not included in the product system under study. The production of the first materials is excluded in line with the cut-off rules. In total 1.54 % of materials are excluded due to cut-off. This is less than 5 % which is the total threshold defined by the underlying PCR. Fly ash and blast furnace slag are excluded due to specific statements in the PCR. While the production of these materials is excluded the materials themselves are part of the calculation. For details on the inventory of cement, see EPDs S-P-00527.

The production process uses (indirectly) secondary fuels. According to the PCR, secondary fuels are modelled to enter the studied system free of environmental loads. They are displayed as a resource use and all emissions occurring during the production process are allocated to the produced products. These cut-offs are related to the cement production.

Material	Reason for exclusion	Process
iron correction, pyrit ash, sand, bottom ash, SiO2, Cr 6+ reducer agent	Cut-off	Raw meal preparation
Fly ash, granulated blast furnace slag (GBFS)	PCR rules	Cement production
Used tyres, mixed biomass, mixed industrial waste, petroleum sludge, solid recovered fuel	Secondary fuel	Clinker production

Table 5: Materials excluded from the product system

4.4 Background data

Background data is included based on generic datasets from the GaBi 6 Database of PE International in the version of 2012. The background data is based on reviewed data from life cycle inventories. As all datasets are validated, the data quality for the entire study can be judged as very good.

4.5 System boundaries

4.5.1 Technical system boundaries

The technical system boundaries are defined according to the provisions of the PCR. Primary raw material is accounted from the quarry, including all processes including transportation to the production facilities.

For transparency reasons the information from the cement EPD S-P-00527 is included within this EPD for concrete.

Secondary raw materials enter the system boundary when reaching the end-of-waste status, as defined in the EU Council Directive on Waste. In the situation where a secondary raw material technically reaches its end-of-waste status during the co-processing of the materials, they are modelled to enter the system at the input boundary of the co-processing chamber. Consequently the co-processing processes including all related emissions is allocated to the production process. Wastes used as fuels are considered from the boundary of the production site. Processes for preparation of the co-processing and treatment of the secondary raw materials, such as drying, are included. All emissions from the co-processing processes have been allocated to the produced products, no environmental loads have been allocated to co-burned wastes.

Material flows and emissions not associated with the production process, such as energy used for personal transportation or wastewater treatment, are not included in this study.

4.5.2 Geographical system boundaries

The geographical system boundary is Romania. All processes are valid for the production sites in Romania. Waste treatment processes are included based on average data valid for the European Union (EU-27). All 13 concrete producing plants of HOLCIM Romania are included: Campulung, Alesd and Turda.

Plant	Share
RMX Brasov	6,4%
RMX Ploiesti	8,6%
RMX Craiova	7,4%
RMX Cluj	7,5%
RMX Targu Mures	5,4%
RMX Satu Mare	5,3%
RMX Oradea	4,4%
RMX Pipera (Bucharest)	13,1%
RMX Chitila (Bucharest)	11,1%
RMX Pantelimon (Bucharest)	4,9%
RMX Clinceni (Bucharest)	10,8%
RMX Sibiu	10,7%
RMX Timisoara	4,6%
Total	**100,0%**

Table 6: RMX plants from Holcim Romania with their respective production share

4.5.3 Temporal system boundaries

All material flows of the processes are based on company and site specific data gathered for the year 2012. All background data originates from the GaBi6 database version of 2012 with validity until 2016

4.6 Comparability

The EPD is established on the basis of the product category rules (PCR) for concrete published by The International EPD® System (UN CPC 475 2013:02 Version 1.0). The LCAs follow the standards ISO 14040:2006 and ISO 14044:2006, as well as the provisions for environmental product declarations in the construction sector established in EN 15804:2012. According to these standards, environmental product declarations do not compare the environmental performance of products in the construction sector. Any comparison of the declared environmental performance of products lies outside the scope of these standards, and is suggested to be feasible only if all compared declarations follow equal standard provisions. Further, any comparative interpretation of the declaration shall reflect the product's application context in a building.

4.7 Results

Based on data from all HOLCIM concrete plants in Romania from the year 2012, the following results have been obtained for the average concrete produced in the Holcim Romania plants. The declared unit is 1m3 of average ready-mix concrete.

Parameter	Unit	A1-A3
Global warming potential	kg CO_2-eq	2,71E+02
Depletion potential of the stratospheric ozone layer	kg R11-eq	8,36E-09
Acidification potential of land and water	kg SO_2-eq	7,81E-01
Eutrophication potential	kg PO_4^{3-}eq	7,82E-02
Formation potential of tropospheric ozone photochemical oxidants	kg ethene-eq	5,66E-02
Abiotic depletion potential for non-fossil resources	kg Sb-eq	7,60E-04

Table 7: Summary of life cycle impact analysis for 1m3 of average ready-mix concrete

Reading tip:

- *2,71E+02 = 2,71 x 10^2 = 271*
- *7,60E-04= 7,60 x 10^{-4} = 0,00076*

Parameter	Unit	A1-A3
Abiotic depletion potential for fossil resources	MJ	1,44E+03
Renewable primary energy as energy carrier	MJ	0
Renewable primary energy resources as material utilization [MJ]	MJ	0
Total use of renewable primary energy resources	MJ	0
Non-renewable primary energy as energy carrier	MJ	1,44E+03
Non-renewable primary energy as material utilization	MJ	0
Total use of non-renewable primary energy resources	MJ	1,44E+03
Use of secondary material [kg]	kg	1,36E+01
Use of renewable secondary fuels [MJ]	MJ	0
Use of non-renewable secondary fuels [MJ]	MJ	3,54E+02
Use of net fresh water	m3	1,58E-03

Table 7: Summary of life cycle inventory indicators for 1 m^3 average ready-mix concrete

4.8 Interpretation

The following table provides an identification of the most significant contributors to a selection of the parameters presented above:

Parameter	Most significant contributor
Primary energy demand	Dominated by the use of non-renewable energy and the corresponding supply chains. The most significant process using energy is the kiln in the cement production.
Water demand	Dominated by the use of surface water related to the generation of electricity. The water use on site is less than 1% of the total freshwater use.
Waste generation	Waste in terms of material waste is generated in upstream processes of electricity production and fuel supply.
Global warming potential	The kiln causes about 83,4 % of the greenhouse gas emissions of concrete production. Emissions in the kiln result from both decarbonation of limestone as well as the burning of fuel.
Acidification potential	Dominated by sulphur dioxide emissions from the kiln and emissions from electricity production.
Eutrophication potential	The kiln is the major source for emission of nitrous oxides. Lignite production is another significant contributor.
Ozone depletion potential	Dominated by emissions from electricity production.
Photochemical ozone creation potential	Dominated by nitrous oxide and sulphur dioxide emissions from the kiln as well as from fuel production for the burning of clinker. Emissions from diesel engines are another major contributor.
ADP elements	Highest contribution associated with the quarry of gypsum for cement production.
ADP fossil	Fossil fuel consumption is dominated by the supply and use of fossil fuels for the kiln in the cement production. Second largest contribution through the supply chain of electricity. Considered electricity mix for Romania.

Table 8: Most significant contributors to life cycle parameters

Concluding, the use of energy is the most significant contributor to environmental impacts associated with cement. Energy is used as electricity and fuel, by far dominated by the kiln. Also contributing is the energy demand related to the excavation of raw materials. The contribution to global warming (carbon emissions) is dominated by the decarbonation of clinker – a process necessary to produce cement, and with that the main driver for the environmental performance of concrete.

5. Other environmental information

Holcim Romania, being aware of its responsibility as cement, concrete and aggregate manufacturer towards the environment, and in particular on the limited natural resources has implemented as part of its integrated management system, an environmental management system. Thus, all the activities that could have a significant impact on the environment are kept under control.

Also, we ensure that the constituent materials used within our products are responsibly sourced and we apply the principles of Sustainable Development and of Environmental Stewardship as a standard business practice in our operations.

In this sense, we measure, monitor, assess and continuously improve our environmental performances. We prevent environmental pollution by implementing in our operations the best available technology and by maintaining and operating our installations in optimum ways. Protecting the environment by preserving non-renewable natural resources, increasing energy efficiency, reducing the environmental emissions, limiting the impact of materials transportation to and from our operations is part of our way in doing business. Holcim is promoting in Romania the reduction, recycling and recovering of waste and the optimization of water consumption in all processes.

More information regarding our environmental and responsibly sourcing objectives and activities are available on http://www.holcim.ro/en/sustainable-development.html

6. References

Council Directive 2008/98/EC on waste, The European Parliament and the Council, November 2008, Official Journal of the European Union, L 312/3, November 2008

EN 15804: 2012, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

EPD S-P-00527 Holcim grey cements

EPD S-P-00528 Holcim aggregates

GaBi 6 2013: Software und Datenbank zur Ganzheitlichen Bilanzierung. LBP, Universität Stuttgart und PE International, 2012

GaBi 6 2013: Dokumentation der GaBi-Datensätze der Datenbank zur Ganzheitlichen Bilanzierung. LBP, Universität Stuttgart und PE International, 2012.

Guinée J B, Gorrée M, Heijungs R, Huppes G, Kleijn R, de Koning A, van Oers L, Sleeswijk A W, Suh S, Udo de Haes H A, de Bruijn H, van Duin R, Huijbregts M A J, Lindeijer E, Roorda A A H, van der Ven B L, Weidema B P. (2001). Life cycle assessment- an operational guide to the ISO standards. Leiden: CML, Leiden University.

ISO 14020:2000 Environmental labels and declarations – General principles

ISO 14040:2006 Environmental management – Life cycle assessment – Principles and framework

ISO 14044: 2006 Environmental management -- Life cycle assessment -- Requirements and guidelines

ISO 14025: 2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures

ISO 21930:2007 Sustainability in building construction – Environmental declaration of building products

Product Category Rules for Cement (UN CPC 3744) 2013:05 Version 2.0, The International EPD System

Product Category Rules for Concrete (UN CPC 375) 2013:02 Version 1.0, The International EPD System

Satterthwaite, Kerry (2013): Petroleum coke economics in cement kilns to 2016, Roskill

Holcim Romania
169 A Calea Floreasca Street, Building B, Floor 7, District 1
Bucharest, RO 014459
Romania
Mihaela.Odangiu@holcim.com
www.holcim.ro
Phone +4021 231 77 08/09
Fax +4021 231 77 14/15