Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Hard-Cem®

from

Kryton International Inc.

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB; EPD is registered through aligned regional licensee; EPD North America (www.epdna.com)
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR for Construction Products, PCR2019:14 version 1.3.3*
PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact
Life Cycle Assessment (LCA)
LCA accountability: Rob Sianchuk, Rob Sianchuk Consulting
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier      Third-party verifier: Thomas Gloria, Industrial Ecology Consultants LLC Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Kryton International Inc.

Contact: info@kryton.com

Description of the organization: Kryton was founded in 1973 and has grown to be a worldwide leader in concrete waterproofing and durability. Kryton revolutionized the industry by inventing the first waterproofing admixture, Krystol Internal Membrane (KIM) in 1983, and again in 2003 with Hard-Cem, the world's first integral hardening admixture for resisting abrasion and erosion.

Product-related or management system-related certifications: REACH Registered

Name and location of production site(s): Cementec Industries Inc. – A Kryton Company
13 Industrial Way SE
Calgary, Alberta
T3S 0A2

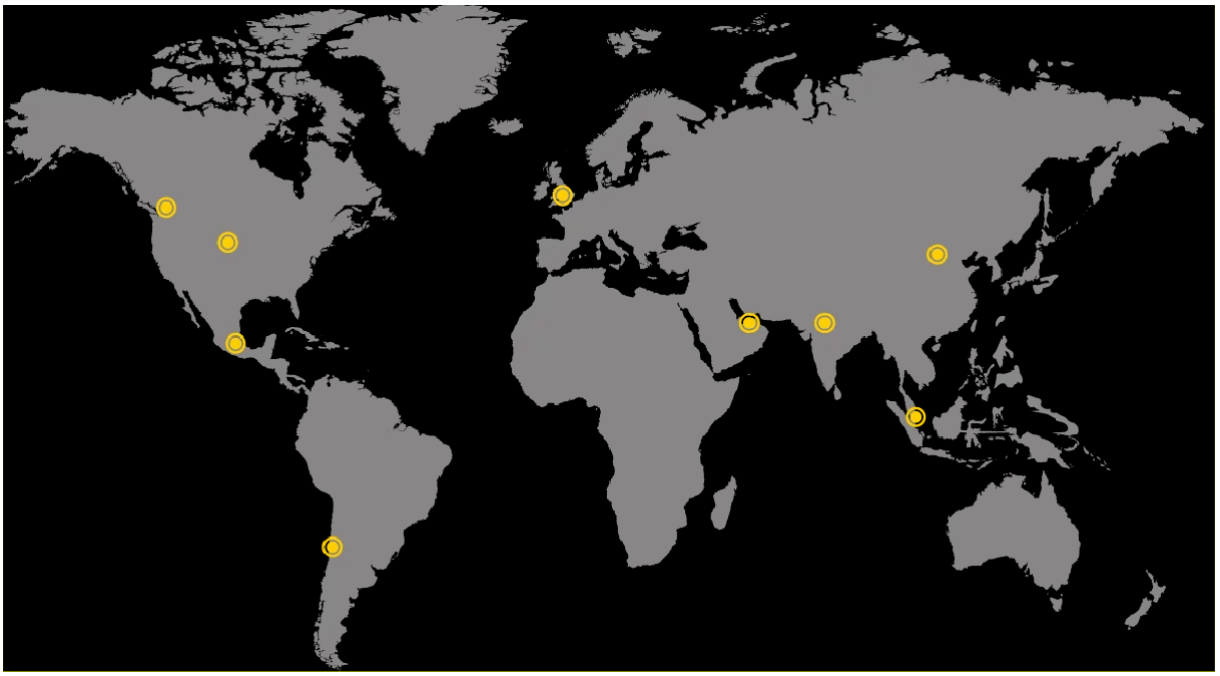
Product information

Product name: Hard-Cem®

Product identification:
Hard-Cem is a black powder substance with a bulk density of 1,650 kg/m^3 and a specific gravity of ~3.55. Packaged as 13.4 kg (29.5 lbs) and 15.0 kg (33.0 lbs) pulpable mixer ready bags, and also available in 1,600 kg super sacks and bulk truck loads.

UN CPC code: 375

Geographical scope: Canada (A1-A3), and Global (C and D)



KRYTON'S GLOBAL NETWORK
Kryton headquarters are in Canada with 10 regional offices in China, India, Mexico, Singapore, UAE, USA and UK. Our regional offices provide technical and sales support to our entire distribution network.

Product description:

The Hard-Cem product considered in this study is an Integral Hardening Admixture (IHA) specified in concrete mix designs for abrasion and erosion resistance by integrating a mineral-metal microstructure into the concrete's cement paste during batching. The recommended uses of Hard-Cem include:

- Distribution Centers and Warehouses
- Manufacturing Facilities
- Big Box Retail Stores
- Superflat Floors
- Storage Facilities
- Public Transportation Stations
- Roads, Bridges, and Overpasses
- Truck Terminals
- Water & Wastewater Infrastructure
- Dams, Spillways and Power Plants
- Airport Runways and Aprons
- Marine Infrastructure
- Mining Infrastructure
- Waste and Recycling Facilities

The standards on applying Hard-Cem in concrete are listed below.

- Guide to Floor and Slab Construction
  - ACI 302.1R - Compatible with all floor classifications
- Specification for Tolerances for Concrete Construction and Materials
  - ACI 117 - Compatible with all Flatness and Levelness classes
- Wear Classification
  - EN 13892-4 - Class AR0.5 (Severe Duty)
- Wear Resistance
  - BLY 7/by45, Bohme Abrasion - Class 1

LCA information

Declared unit: 1 kg of Hard-Cem product

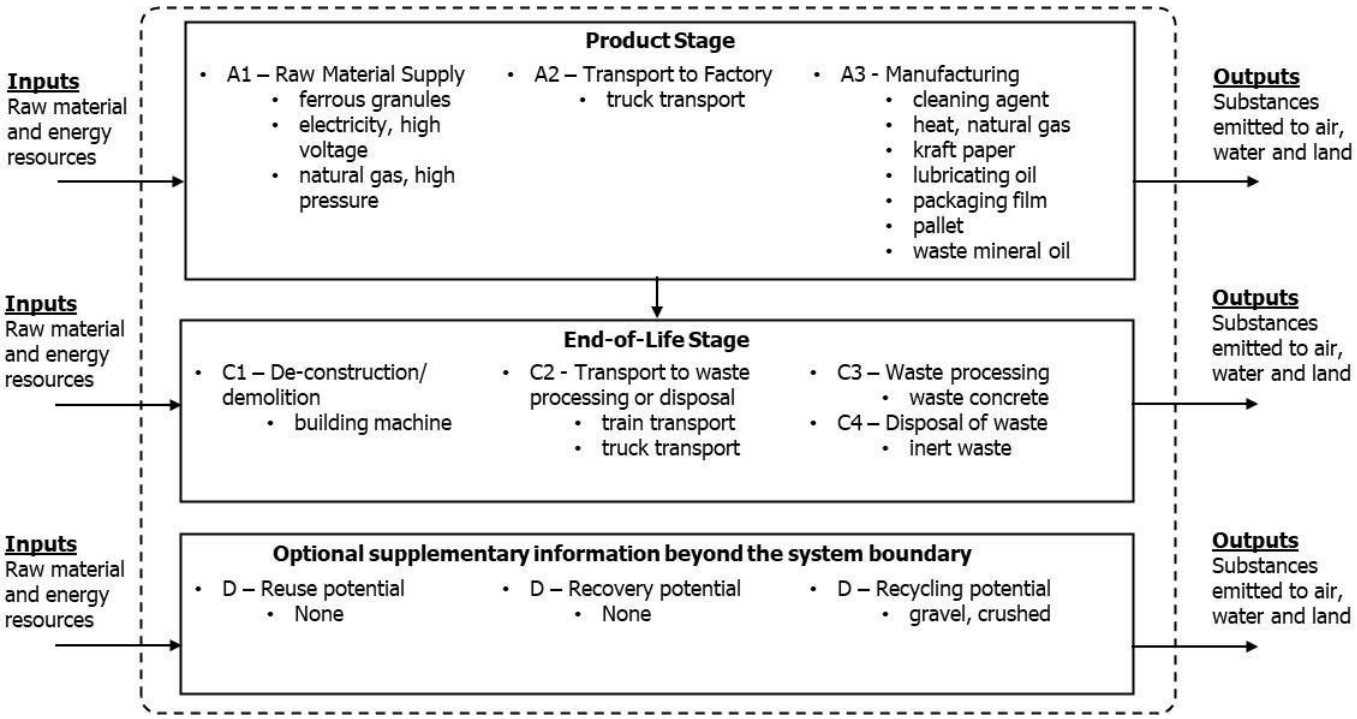
Reference service life: N/A

Time representativeness: 12-month production period spanning January 2023 to December 2023.

Database(s) and LCA software used: ecoinvent 3.9.1 (EN15804 add-on by GreenDelta) and openLCA 2.1.0

Description of system boundaries: Cradle to gate with modules C1–C4 and module D (A1–A3 + C + D).

System diagram:



Transparency on electricity in A3: For electricity used in the manufacturing process, the energy source mix is 42.3% natural gas, 37.4% brown coal, 10.3% wind energy, 8.6% hydropower, 0.7% biomass, 0.3% nuclear, 0.3% black coal, and 0.1% geothermal. The GWP-GHG indicator result of the background activity dataset ‘market for electricity, high voltage’ for 2019 CA-AB is 0.77 kg CO2 eq/kWh.

Scenarios and additional technical information:

- C1 - De-construction/demolition
  - Deconstruction, including dismantling or demolition, of the product from the building, including initial on-site sorting of the materials is assumed as 0.0437 MJ per kg KIM.
- C2 - Transport to waste processing or disposal
  - Transportation of the discarded product as part of the waste processing, e.g. to a recycling site and transportation of waste e.g. to final disposal

Transport mode	Fuel Type	Distance (km)
Transport by truck	Diesel	20
Transport by train	Diesel	50

- C3 - Waste processing
  - Waste processing, including collection of waste fractions from the deconstruction and waste processing of material flows intended for reuse, recycling and energy recovery – 58% recovery for recycling by dry sorting at a plant for building wastes with pre-sorting of mixed waste, crushing and manual sorting.
- C4 - Disposal
  - Waste disposal, including physical pre-treatment and management of the disposal site – 42% collected with mixed construction waste, disposed as inert waste.
- D - Optional supplementary information beyond the system boundary
  - Potential benefits and loads from reuse, recovery, recycling – Estimate quality and net output flow of recycled KIM product substitute for gravel, assuming no material losses between the point of end-of-waste state and point of substitution, and using current average technologies and practice.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	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
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	**X**	**X**	**X**	***ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**X**	**X**	**X**	**X**	**X**
Geography	**CA, GLO**	**GLO**	**CA, GLO**										**GLO**				**GLO**
Specific data used	**>90%**			**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Variation – products				**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Variation – sites	**Not applicable**			**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Ferrous granules	1	100	0
TOTAL	1	100	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Kraft bags	0.00324	0.3%	0.00136
Pallets	0.00353	0.4%	0.00167
TOTAL	0.00677	0.7%	0.00302

Dangerous substances from the Candidate List of Substances of Very High Concern (SVHC) - This product does not contain any substances in the Candidate List of SVHC which exceeds the limits for registration with the European Chemicals Agency (i.e. in amounts greater than 0.1% of the weight of the product).

Results of the environmental performance indicators

The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks. The use of the results of modules A1-A3 should not be used without considering the results of module C.

Mandatory impact category indicators according to EN 15804 (based on EF 3.0)

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	3.15E-01	4.44E-03	3.53E-03	3.65E-03	4.13E-03	-6.10E-03
GWP-biogenic	kg CO_2 eq.	-4.56E-03	1.16E-06	5.92E-06	7.42E-03	4.37E-06	-1.84E-05
GWP-luluc	kg CO_2 eq.	1.02E-04	4.87E-07	1.16E-05	6.83E-06	6.40E-06	-5.93E-06
GWP-total	kg CO_2 eq.	3.09E-01	4.44E-03	3.55E-03	5.02E-03	4.14E-03	-6.12E-03
ODP	kg CFC 11 eq.	2.33E-09	6.90E-11	5.68E-11	4.69E-11	9.75E-11	-5.48E-11
AP	mol H^+ eq.	8.77E-04	4.02E-05	1.91E-05	2.10E-05	2.71E-05	-3.64E-05
EP-freshwater	kg P eq.	1.51E-04	1.33E-07	3.56E-07	1.06E-06	3.62E-07	-2.00E-06
EP-marine	kg N eq.	2.82E-04	1.86E-05	7.34E-06	6.43E-06	1.04E-05	-8.61E-06
EP-terrestrial	mol N eq.	2.73E-03	2.03E-04	7.81E-05	6.79E-05	1.11E-04	-1.03E-04
POCP	kg NMVOC eq.	1.06E-03	6.00E-05	2.54E-05	2.17E-05	3.80E-05	-2.90E-05
ADP-minerals&metals[1]	kg Sb eq.	2.83E-07	1.34E-09	7.93E-09	1.21E-08	6.42E-09	-2.95E-08
ADP-fossil[1]	MJ	3.97E+00	5.16E-02	4.42E-02	4.97E-02	7.62E-02	-7.03E-02
WDP[1]	m^3	4.08E-02	2.26E-04	6.05E-04	1.55E-03	3.22E-03	-9.35E-03
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption						

Additional mandatory impact category indicators according to EN 15804

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[2]	kg CO_2 eq.	3.15E-01	4.44E-03	3.54E-03	3.65E-03	4.14E-03	-6.10E-03
ETP-fw[1]	CTUe	2.67E+00	4.62E-02	6.44E-02	7.19E-02	8.04E-02	-1.23E-01
HTP-c[1]	CTUh	9.06E-11	1.35E-12	2.08E-12	1.82E-12	1.97E-12	-4.96E-12
HTP-nc[1]	CTUh	2.30E-09	2.93E-11	5.11E-11	4.63E-11	5.21E-11	-1.07E-10
IRP[3]	kBq U-235 eq	2.65E-03	2.69E-05	5.56E-05	2.07E-04	6.50E-05	-6.05E-04
SQP[1]	Pt	2.49E+00	3.90E-03	3.32E-02	6.72E-02	1.44E-01	-1.31E-01
PM	disease inc.	8.49E-09	1.11E-09	3.03E-10	2.63E-09	5.35E-10	-5.01E-10
Acronyms	ETP-fw = Ecotoxicity, freshwater, HTP-c = Human toxicity, cancer effects, HTP-nc = Human toxicity, non-cancer effects, IRP = Ionising radiation, SQP = Land use, PM = Particulate matter						

[1] Disclaimer - The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

[2] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

[3] Disclaimer - This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive

waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Additional voluntary impact category indicators according to TRACI 2.1

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP 100	kg CO_2 eq	3.06E-01	4.29E-03	3.42E-03	3.50E-03	3.91E-03	-5.82E-03
ODP	kg CFC-11 eq	2.56E-09	7.41E-11	6.31E-11	6.01E-11	1.06E-10	-7.95E-11
EP	kg N eq	1.18E-03	3.63E-06	4.05E-06	9.17E-06	4.65E-06	-1.65E-05
AP	kg SO_2 eq	7.63E-04	3.71E-05	1.72E-05	1.85E-05	2.44E-05	-3.13E-05
POCP	kg O_3 eq	1.57E-02	1.18E-03	4.50E-04	3.90E-04	6.43E-04	-5.12E-04
Acronyms	GWP 100 = Global warming potential, ODP = Ozone depletion potential, EP = Eutrophication potential, AP = Acidification potential, POCP = Photochemical oxidant creation potential						

Resource use indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	4.11E+00	5.20E-02	4.46E-02	5.01E-02	7.68E-02	-7.10E-02
PERM	MJ	2.29E-01	5.22E-03	4.00E-03	3.12E-03	7.43E-03	-2.45E-03
PERT	MJ	4.34E+00	5.72E-02	4.86E-02	5.32E-02	8.42E-02	-7.35E-02
PENRE	MJ	3.97E-01	3.23E-04	8.67E-04	3.24E-03	9.09E-04	-6.49E-03
PENRM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	3.97E-01	3.23E-04	8.67E-04	3.24E-03	9.09E-04	-6.49E-03
SM	kg	1.00E+00	3.30E-05	4.82E-05	5.48E-05	4.92E-05	-2.34E-04
RSF	MJ	5.45E-04	3.64E-06	5.98E-06	1.49E-05	8.46E-06	-7.50E-05
NRSF	MJ	7.99E-04	9.85E-06	3.26E-05	7.80E-05	2.83E-05	-2.04E-04
FW	m^3	7.88E-04	3.06E-06	1.10E-05	3.15E-05	7.06E-05	-2.07E-04
Acronyms	PERE - Use of renewable primary energy excluding renewable primary energy resources used as raw materials, PERM = Use of renewable primary energy resources used as raw materials, PERT = Total use of renewable primary energy resources, PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials, PENRM = Use of non-renewable primary energy resources used as raw materials, PENRT = Total use of non-renewable primary energy resources, SM = Use of secondary materials, RSF = Use of renewable secondary fuels, NRSF = Use of non-renewable secondary fuels, FW = Use of net fresh water						

Waste and Output flow indicators

Results per declared unit							
Indicator	**Unit**	**A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	kg	2.94E-03	4.75E-05	7.48E-05	1.20E-04	7.52E-05	-3.06E-04
NHWD	kg	8.47E-02	3.52E-05	2.75E-03	7.45E-02	4.20E-01	-9.56E-04
RWD	kg	6.69E-07	6.22E-09	1.33E-08	5.02E-08	1.54E-08	-1.47E-07
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	kg	1.89E-03	2.72E-05	3.82E-05	4.62E-05	3.99E-05	-1.86E-04
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acronyms	HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, CRU = Components for re-use, MR = Material for recycling, MER = Materials for energy recovery, EEE = Exported energy, electricity, EET = Exported energy, thermal						

Additional environmental information

Project service life - The use of Hard-Cem admixture in concrete mixes may provide long term environmental benefits not considered in the system boundaries of this EPD. The effects of climate change are projected to accelerate the deterioration of concrete, such as increased abrasion and erosion due to increased stormwater runoff. Battery electric vehicles and equipment may increase wear on roadways and concrete flatwork due to increased weight and friction. Hard-Cem admixture will increase durability and may therefore provide significant whole lifecycle sustainability benefits by extending service life and reducing the need for future repairs (see Effects on Durability).

Effects on durability – Hard-Cem has been shown to provide a number of benefits that can be projected to increase durability and reduce the total environmental impact of the concrete over its lifecycle. These benefits include greatly reduced abrasion wear under heavy duty conditions[4] and reduced surface chipping[5]. Based on abrasion loss, concrete treated with Hard-Cem may have double the wear life of the same untreated concrete. Concrete treated with Hard-Cem and properly air entrained has demonstrated excellent durability against freeze-thaw conditions[6] and salt scaling.[7]

Project optimization - In some cases, the use of durability enhancing admixtures such as Hard-Cem may allow other protective systems (such as liquid concrete densifiers) to be eliminated from the project, reducing the materials, VOC emissions, water use and labour required to install them. When Hard-Cem is used to replace mineral or metallic “shake-on” hardeners, the potential exposure of site personal to construction dust and crystalline silica is reduced, resulting in improved construction site hygiene. In cases where the concrete no longer needs to have an abrasion resisting coating applied to the surface, the concrete for that project will be more suitable for recycling at the end of its service life.

Concrete mix optimization - Admixtures may provide a large performance benefit to the concrete relative to their usage level and environmental impact as published in an EPD. Users should consider the opportunity to use Hard-Cem (and other admixtures) to maintain durability when developing lower carbon concrete mixes. Hard-Cem may displace an equal amount of construction sand in the concrete mix, reducing the amount of sand required.

Reduced project waste - When provided in mixer ready bags, Hard-Cem results in no packaging waste. Hard-Cem is also available in bulk which result in elimination of any packaging.

LEED (Leadership in Energy and Environmental Design) – Hard-Cem may help contribute to a number of LEED credits in several categories. Consult the manufacturer and your LEED professional to identify potential LEED contributions.

[4]Tested to ASTM C627 and ASTM C779 procedure C, [5]ASTM C535 (Los Angeles Machine), [6]ASTM C666, [7]ASTM C627.

Differences versus previous versions

This is the first version of the Hard-Cem® EPD.

References

EN 15804:2012+A2:2019 E “Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products”

International EPD® System, 2021. General Programme Instructions for the International EPD System, version 4.0

International EPD® System, 2021. PCR 2019:14 Construction products, version 1.11

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”

Rob Sianchuk Consulting, 2024. Project report: Life cycle assessment of Hard-Cem version 1.2

EPD®

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