epd-norway
Global Program Operator

Environmental Product Declaration

In accordance with ISO 14020, ISO 14025 and EN15804+A2

Carbon Crusher Bio-Road

Method for Road Rehabilitation with Bio-Binder

Owner of the declaration:
Carbon Crusher AS

Product name:
Carbon Crusher Bio-Road - rehabilitation method with bio-binder

Functional unit:
One square meter (~11 sq. ft) of rehabilitated road divided by 20 years of estimated service life (ESL) of the road after the rehabilitation.

Product category /PCR:
NPCR Part A:2021 Construction products and services Version 2.0 and C-PCR-012 for rehabilitation of highways, streets and roads Version 2021-07-09.

Program holder and publisher:
The Norwegian EPD foundation

Declaration number:
NEPD-5450-4580-EN

Registration number:
NEPD-5450-4580-EN

Issue date: 30.11.2023

Valid to: 30.11.2028

ver-210224

CARBON CRUSHER

The Norwegian
EPD Foundation

General information

Product:
Carbon Crusher Bio-Road
Method for Road Rehabilitation with Bio-Binder

Program Operator:
The Norwegian EPD Foundation
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Declaration Number:
NEPD-5450-4580-EN

This declaration is based on Product Category Rules:
NPCR Part A:2021 Construction products and services Version 2.0 and C-PCR for rehabilitation of highways, streets, and roads Version 2021-07-09

Statements:
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to the manufacturer, life cycle assessment data, and evidences.

Declared unit:
-

Declared unit with option:
-

Functional unit:
One square meter of rehabilitated road divided by 20 years of estimated service life (ESL) of the road after the rehabilitation.

Verification:
Independent verification of the declaration and data, according to ISO 14025:2010

internal ☐ External X

Mie Vold, LCA.no AS
Independent verifier approved by EPD Norway

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Manufacturer:
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Place of production:
Norway and United States of America

Management system:
ISO 14001:2015 (certification date: 24th November)

Organisation no:
924 601 132

Issue date:
30.11.2023

Valid to:
30.11.2028

Year of study:
2023

Comparability:
EPDs from other programs than EPD Norge may not be comparable.

The EPD has been worked out by:
Mafalda Silva and Mehrdad Ghorbani Mooselu

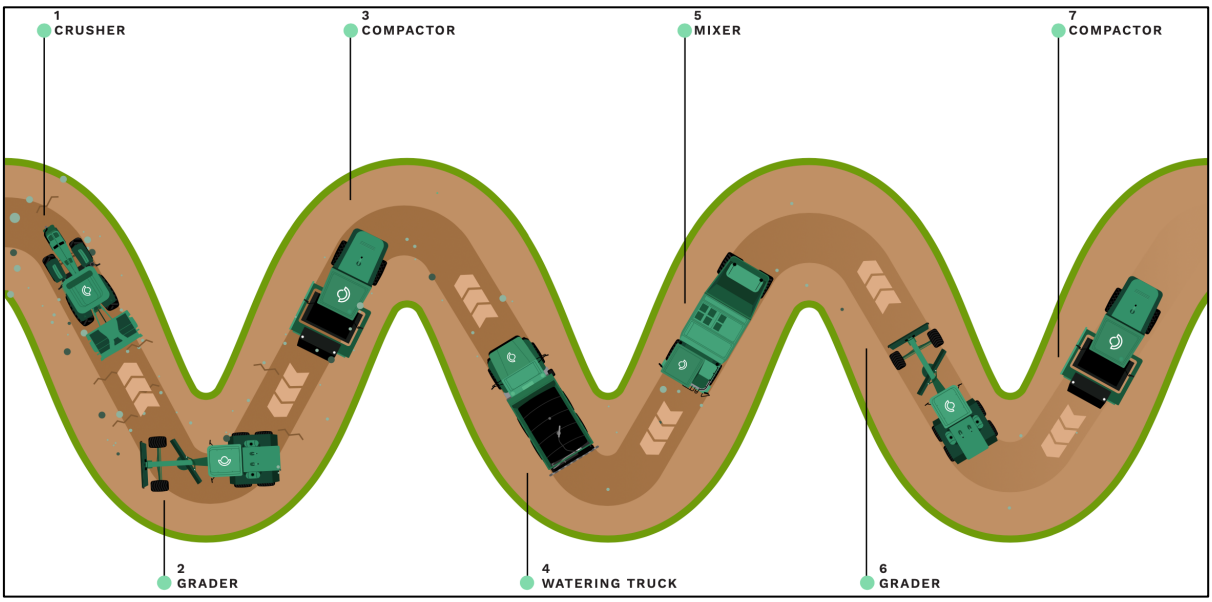
Approved

Manager of EPD Norway

Product

Product description:

The Carbon Crusher Bio-Road service starts with a machine that crushes down the top layer of the road. After this, the road is lightly graded to ensure that all constituent materials of the road are retained and reused within the confines of the road's body. The next step is compacting to ensure drivability on the road and allow for easier use of machines in the following steps. The road is then watered down to ensure correct moisture content in the ground. Then, we have a mixing process where an optimal solution of binder is applied and mixed directly into the top layer. The final steps consist of grading to ensure the correct profile of the road and, finally, compaction to increase the load-bearing capacity, provide better mechanical stability, improve resistance to permanent deformation (settling), and reduce moisture penetration.



Technical data:

Rehabilitation technique applied	Cold-In-Place recycling and stabilisation with biopolymer
Traffic Management System Characteristics	Mixed traffic
Traffic intensity of the road	Both heavy and normal traffic use
Road type	County Road (Fylkesvei)
Junctions	One junction, on average
Speed limits	Typical speed is 60 kilometres per hour (*37 mph)* with a speed limit of 90 kilometres per hour (*56 mph*) as per Norwegian legal speed limit for County roads
Number of lanes before and after rehabilitation	2 lanes before and after
Road width	7 meters (23 feet)
Pavement type	Uniform hardened, dust-retaining smooth gravel surface. The customer can apply asphalt at their discretion after the rehabilitation process is completed
Roadside equipment	Legal requirements and existing signage will be preserved

Maintenance after rehabilitation	One levelling with the grader, one pass for each lane - process recommended every 3 years
Annual average daily traffic (AADT)	5 000 vehicles per day
Bearing capacity.	10-15 tonnes per axle

For more information from the product data sheet please see: www.carboncrusher.com

This declaration can be used to represent a county road located in United States of America (USA) rehabilitated by Carbon Crusher with the Carbon Crusher Bio-Road service by using the scaling factors given in the table on page 11.

Market:
Norway and United States of America

Estimated service life, product:
20 years

LCA: Calculation rules

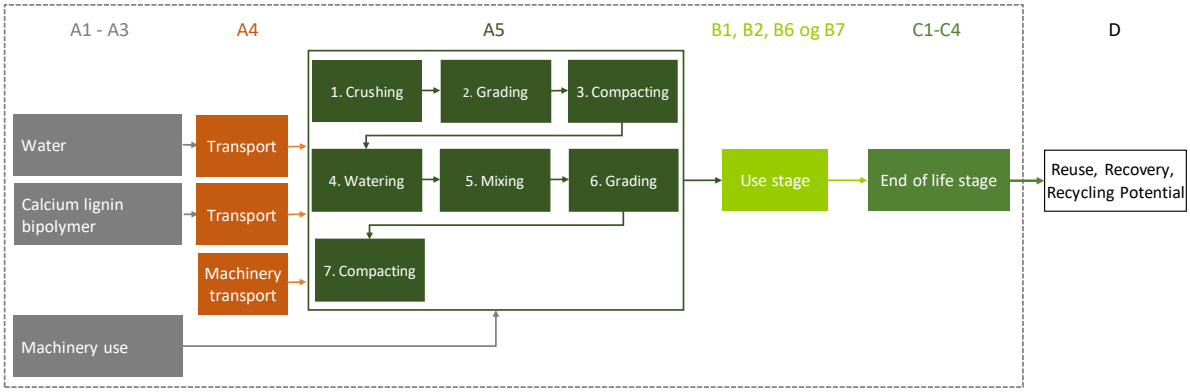
Functional unit:
One square meter of rehabilitated road divided by 20 years of estimated service life (ESL) of the road after the rehabilitation.

Data quality:
This is a specific EPD for the Carbon Crusher Bio-Road rehabilitation process applied in a county road located in Norway. Information regarding machinery and materials used was collected in 2023 for the specific rehabilitation project. Other data are from Ecoinvent v3.9, released in 2022, but with some changes to improve representativeness.

Allocation:
The allocation is made in accordance with the provisions of EN 15804. For the background system, all data is allocated according to the "cut-off" in Ecoinvent. This means that all burdens related to the extraction of raw materials and production of virgin products are allocated to the first life cycle, while life cycles that use recycled material only include the processes linked to recycling. For the foreground system, no allocation was performed as there was no need.

Flowchart:
The Carbon Crusher Bio-Road services starts with a machine that crushes down the top layer of the road. After this the road is lightly graded to ensure that all constituent materials of the road are retained and reused within the confines of the road's body. Next step is compacting to ensure drivability on the road and allow for easier use of machines in the following steps. The road is then watered down to ensure correct moisture content in the ground. Next step is the mixing process where an optimal solution of binder is applied and mixed directly into the top layer. The final steps consist of grading to ensure correct profile of the road and finally compaction to increase the load

bearing capacity, provide better mechanical stability, improve resistance to permanent deformation (settling), and reduce moisture penetration.



The machinery use depicted above as an input to life cycle stage A5 comprises the entire machinery life cycle, i.e., production and waste handling at its EoL, diesel production, and emissions to air and soil during its use.

System boundary:

This EPD represents a cradle-to-grave and module D analysis as specified in c-PCR-012, hence comprising modules A1-A3, A4, A5, B1, B2, B6, B7 and D. In addition, modules C1-C4 were considered according to the provisions of EN 15804:2012+A2:2019.

Cut-off criteria:

All major raw materials and all the essential energy are included. The production process for raw materials and energy flows that are included with very small amounts (<1%) are not included. This cut-off rule does not apply for hazardous materials and substances.

LCA: Scenarios and additional technical information

The following information describes the scenarios in the different modules of the EPD. Note that this EPD follows the c-PCR-012 and therefore, in a road rehabilitation service, only module B4 is considered. Within module B4, scenarios for modules A4, A5, B1, B2, B6 and B6 shall be reported, which are presented below. Scenarios for C1-C4 and D modules are also addressed.

Transport to the rehabilitation site (A4)

Module A4 comprises the transport of bio-binder from the production site in Sarpsborg (Norway), the transport of freshwater, and the transport of the required machinery (crusher, grader, compactor and mixer) to the rehabilitation site.

Specific transport distances were provided by Carbon Crusher for the considered county road. The transport of bio-binder is done by road and ferry over a total travel distance of 108 km. The freshwater is transported over a travel distance of 25 km by road transport mode. Regarding the employed machinery, the tractor with crusher mounted plus accessories is transported over a travel distance of 112 km, while the remaining employed machinery is transported over 37 km. The transport of machinery is done by road transport mode.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance [km]	Fuel/Energy consumption	Unit
Boat, Bio-binder	50	Ferry	10	2.92E-02	l/tkm
Truck, Bio-binder	53	16-32 metric ton, EURO6	98	4.37E-02	l/tkm
Truck, Freshwater	53	> 32 metric ton, EURO6	25	2.29E-02	l/tkm
Truck, Crusher	53	> 32 metric ton, EURO6	112	2.29E-02	l/tkm
Truck, Other machinery	53	> 32 metric ton, EURO6	37	2.29E-02	l/tkm

Construction process (A5)

Module A5 comprises the construction works in the rehabilitation site for the manufacturing of a new pavement road with the use of onsite recycled material. According to information provided by Carbon Crusher the only activity comprised in A5 module is the use of different types of machinery required in the considered rehabilitation service. Therefore, the use of machinery comprising their entire life cycle, i.e., tractor production (and trailer if applicable), diesel production, emissions to air resulting from diesel combustion and emissions to soil from tire abrasion during use, as well as waste handling of tractor (and trailer if applicable) at their EoL are included in this module. Values are reported per one square meter.

Scenario information	Unit	Value
Water consumption	m^3	2.99E-03
Electricity consumption	kWh	0
Other energy carriers, Diesel, Tractor with crusher mounted plus accessories	MJ	1.08E+00
Other energy carriers, Diesel, Tractor grader	MJ	6.56E-01
Other energy carriers, Diesel, Tractor compactor	MJ	4.57E+00
Other energy carriers, Diesel, Tractor with mixer	MJ	6.75E-01
Other energy carriers, Diesel, Watering/binder truck	kg	1.25E-02
Material loss	kg	0
Output materials from waste treatment	kg	0

Use (B1)

There are no LCA-related environmental impacts during use.

Maintenance (B2)/Repair (B3)

It is assumed that in a normal use scenario, there will be one maintenance every three years by using a tractor grader. The use and associated transport of the grader to the rehabilitation site are included in this life cycle stage. As for module A5, the use of a tractor grader in this module accounts for the impacts associated with its production, waste handling at its EoL, diesel production, emissions to air resulting from diesel combustion and to soil from tire abrasion during its use. Specific information regarding the transport of the tractor grader to the rehabilitation site and diesel consumption per square meter linked to the maintenance activity were provided by Carbon Crusher.

It should be noted that there is no use of additional binder during the maintenance activities.

Type	Capacity utilisation (incl. return) %	Type of vehicle	Distance [km]	Fuel/Energy consumption	Unit
Truck, Tractor grader	53	> 32 metric ton, EURO6	37	2.29E-02	l/tkm

Scenario information	Unit	Value
Maintenance cycle*	years	3
Auxiliary	kg	0
Other resources	kg	0
Water consumption	m^3	0
Electricity consumption	kWh	0
Other energy carriers, Diesel, Tractor grader	MJ	2.61E+00
Material loss	kg	0

Operational energy (B6) and water consumption (B7)

According to information provided by Carbon Crusher the considered rehabilitation service does not require the use of water or energy during use. To note that operations linked to removal of snow and road washing were considered out of the scope of the study.

End of Life (C1, C2, C3, C4)

According to information provided by Carbon Crusher there is no waste streams resulting from the considered rehabilitation service. In addition, given the fact that the machinery used have an associated lifetime of 7 000 hours and that during road's estimated service life the hours used in the rehabilitation plus maintenance services would be approximately 0.0003% of the machinery lifetime, it was considered that the waste treatment of machinery at its EoL should not be included in this study. However, the oxidation of biogenic carbon comprised in the binder at the EoL of road's rehabilitation service is considered in this study. The carbon content of the binder is used to calculate the climate impact linked to its oxidation at the end of life of road's rehabilitation service, module C4, by assuming that 2.16% of the carbon content is oxidized.

Benefits and loads beyond the system boundaries (D)

The Carbon Crusher Bio-Road rehabilitation service does not have any associated waste streams. The aggregated masses that already exist in the rehabilitation site are 100% re-used during the crushing and grading operation processes (module A5). Further, there is no packaging associated with Carbon Crusher Bio-Road rehabilitation service nor with the liquid bio-binder. Therefore, there are no benefits beyond system boundaries to report.

LCA: Results

As specified in the PCR and EN 15804:2012+A2:2019, the LCA results are presented in the following tables for the environmental impact categories, resource indicators, and waste and outflow indicators. The impacts have been analyzed excluding long-term emissions.

LCA results refer to a functional unit of one square meter of rehabilitated road divided by 20 years of estimated service life (ESL) of the road after rehabilitation. To get the full lifetime emissions, the values

need to be multiplied by 20. To note that life cycle stages B6, B7 and D are not illustrated in the tables below as they have no associated environmental burdens.

System boundaries (X=included, MND= module not declared, MNR=module not relevant)

Product stage			Assembly stage		Use stage							End of life stage				Benefits & loads beyond system boundary
Raw materials	Transport	Manufacturing	Transport	Assembly	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
X	X	X	X	X	X	X	MNR	X	MNR	X	X	MNR	MNR	MNR	X	X

Core environmental impact indicators

Indicator	Unit	A1-A3	A4	A5	B2	C4
GWP-total	kg CO_2 eq.	-0.35	0.0088	0.039	0.013	0.0080
GWP-fossil	kg CO_2 eq.	0.08	0.0088	0.039	0.013	0
GWP-biogenic	kg CO_2 eq.	-0.43	0.0000075	0.0000773	0.0000260	0.0080
GWP-LULUC	kg CO_2 eq.	0.00048	0.00000445	0.00001393	0.00000363	INA
ODP	kg CFC11 eq.	5.92E-09	1.89E-10	7.17E-10	2.42E-10	INA
AP	mol H^+ eq.	7.64E-04	3.38E-05	2.79E-04	1.01E-04	INA
EP-freshwater	kg P eq.	5.76E-06	6.94E-08	1.92E-07	5.65E-08	INA
EP-marine	kg N eq.	1.09E-04	8.45E-06	1.27E-04	4.70E-05	INA
EP-terrestial	mol N eq.	8.68E-04	9.06E-05	1.39E-03	5.12E-04	INA
POCP	kg NMVOC eq.	3.48E-04	4.01E-05	4.42E-04	1.61E-04	INA
ADP-M&M	kg Sb eq.	1.34E-06	2.74E-08	1.60E-07	5.62E-08	INA
ADP-fossil	MJ	1.10E+00	1.25E-01	4.79E-01	1.62E-01	INA
WDP	m^3	4.39E-02	5.05E-04	1.50E-03	4.82E-04	INA

GWP-total: *Global Warming Potential;* ***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; See "additional Norwegian requirements" for indicator given as PO4 eq.* ***EP-marine:*** *Eutrophication potential, fraction of nutrients reaching freshwater end compartment;* ***EP-terrestrial:*** *Eutrophication potential, Accumulated Exceedance;* ***POCP****: Formation potential of tropospheric ozone;* ***ADP-M&M****: Abiotic depletion potential for non-fossil resources (minerals and metals);* ***ADP-fossil:*** *Abiotic depletion potential for fossil resources;* ***WDP:*** *Water deprivation potential, deprivation weighted water consumption;* ***INA*** *Information not available*

Additional environmental impact indicators

Indicator	Unit	A1-A3	A4	A5	B2	C4
PM	Disease incidence	6.16E-09	6.40E-10	8.42E-10	2.09E-10	INA
IRP	kBq U235 eq.	4.96E-03	6.10E-05	2.62E-04	8.29E-05	INA
ETP-fw	CTUe	1.21E+01	6.59E-02	2.23E-01	7.54E-02	INA
HTP-c	CTUh	1.56E-10	3.99E-12	1.42E-11	4.17E-12	INA
HTP-nc	CTUh	2.56E-08	1.10E-10	1.15E-09	4.08E-10	INA
SQP	Dimensionless	3.22E+01	7.43E-02	4.37E-02	1.44E-02	INA

PM: *Particulate matter emissions;* ***IRP:*** *Ionizing radiation, human health;* ***ETP-fw:*** *Ecotoxicity (freshwater);* ***ETP-c:*** *Human toxicity, cancer effects;* ***HTP-nc:*** *Human toxicity, non-cancer effects;* ***SQP:*** *Land use related impacts / soil quality;* ***INA*** *Information not available*

Classification of disclaimers to the declaration of core and additional environmental impact indicators

ILCD classification	Indicator	Disclaimer
ILCD type / level 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD type / level 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD type / level 3	Abiotic depletion potential for non-fossil resources (ADP-minerals & metals)	2
	Abiotic depletion potential for fossil resources (ADP-fossil)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

Disclaimer 1 – This impact category deals mainly with the eventual impact of low-dose ionizing radiation on the human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure, or 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.
Disclaimer 2 – 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 experience with the indicator

Resource use

Indicator	Unit	A1-A3	A4	A5	B2	C4
RPEE	MJ	6.69E+00	1.90E-03	1.44E-02	4.53E-03	INA
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
TPE	MJ	6.69E+00	1.90E-03	1.44E-02	4.53E-03	INA
NRPE	MJ	1.10E+00	1.25E-01	4.79E-01	1.62E-01	INA
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
TRPE	MJ	1.10E+00	1.25E-01	4.79E-01	1.62E-01	INA
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
W	m^3	1.04E-02	1.76E-05	9.97E-05	3.32E-05	INA

RPEE *Renewable primary energy resources used as energy carrier;* ***RPEM*** *Renewable primary energy resources used as raw materials;* ***TPE*** *Total use of renewable primary energy resources;* ***NRPE*** *Non-renewable primary energy resources used as energy carrier;* ***NRPM*** *Non-renewable primary energy resources used as materials;* ***TRPE*** *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;* ***W*** *Use of net fresh water;* ***INA*** *Information not available*

End of life – Waste

Indicator	Unit	A1-A3	A4	A5	B2	C4
HW	kg	1.07E-05	7.83E-07	2.33E-06	7.51E-07	INA
NHW	kg	7.40E-02	7.20E-03	6.21E-03	1.88E-03	INA
RW	kg	2.59E-06	3.93E-08	1.45E-07	4.57E-08	INA

HW *Hazardous waste disposed;* ***NHW*** *Non-hazardous waste disposed;* ***RW*** *Radioactive waste disposed;* ***INA*** *Information not available*

End of life – output flow

Indicator	Unit	A1-A3	A4	A5	B2	C4
CR	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
MR	kg	9.88E-06	0.00E+00	0.00E+00	0.00E+00	INA
MER	kg	1.77E-03	0.00E+00	0.00E+00	0.00E+00	INA
EEE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
ETE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA

CR *Components for reuse;* ***MR*** *Materials for recycling;* ***MER*** *Materials for energy recovery;* ***EEE*** *Exported electric energy;* ***ETE*** *Exported thermal energy;* ***INA*** *Information not available*

Reading example: 9.0E-03 = 9.0*10-3 = 0.009

Information describing the biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	1.01E-01
Biogenic carbon content in the accompanying packaging	kg C	0.00E+00

Note: 1 kg biogenic carbon is equivalent to 44/12 (approx. 3.67) kg CO_2

Considering that the bio-binder used in the Carbon Crusher Bio-Road is an integral part of the road and therefore the "product" under assessment, the biogenic carbon content stated in the tables above is linked to the production of the bio-binder produced by Borregaard AS. To note that there is no packaging associated with Carbon Crusher Bio-Road rehabilitation service neither with the liquid bio-binder.

Additional requirements

Greenhouse gas emission from the use of electricity in the manufacturing phase

The Carbon Crusher Bio-Road rehabilitation service provided by Carbon Crusher does not require the use of electricity. Therefore, no electricity background data is stated in this Section.

Additional environmental impact indicators required in NPCR Part A for construction products

In order to increase the transparency of biogenic carbon contribution to climate impact, the indicator GWP-IOBC is required as it declares climate impacts calculated according to the principle of instantaneous oxidation. GWP-IOBC is also referred to as GWP-GHG in context to Swedish public procurement legislation.

Indicator	Unit	A1-A3	A4	A5	B2	C4
GWP-IOBC	kg CO_2 eq.	2.52E-02	8.83E-03	3.89E-02	1.33E-02	-3.64E-01

GWP-IOBC *Global warming potential calculated according to the principle of instantaneous oxidation.*

Hazardous substances

The declaration is based upon reference to threshold values and/or test results and/or material safety data sheets provided to EPD verifiers. Documentation is available upon request to the EPD owner.

- ☑ The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- ☐ The product contains substances given by the REACH Candidate list or the Norwegian priority list that are less than 0.1 % by weight.
- ☐ The product contains dangerous substances, more than 0.1% by weight, given by the REACH Candidate List or the Norwegian Priority list, see table.
- ☐ The product contains no substances given by the REACH Candidate list or the Norwegian priority list. The product is classified as hazardous waste (Avfallsforskiften, Annex III), see table.

Indoor environment

Not applicable.

Core indicators applied to Carbon Crusher Bio-Road rehabilitation service in United States of America

The material, machinery use, applied process, and road characteristics of a country road rehabilitation service located in USA are considered the same as for the Norwegian service considered in this EPD, only presenting small variations in the choice of background processes in order to make them more representative of the American conditions. For this reason, in the table below one may find the impacts linked to the rehabilitation service provided by Carbon Crusher to a county road located in USA.

Carbon Crusher Bio-Road USA, Core indicators

Indicator	Unit	A1-A3	A4	A5	B2	C4
GWP-total	kg CO_2 eq.	-0.30	0.033	0.039	0.016	0.0083
GWP-fossil	kg CO_2 eq.	0.17	0.033	0.039	0.016	0
GWP-biogenic	kg CO_2 eq.	-0.47	0.0000212	0.0000041	-0.0000017	0.0083
GWP-LULUC	kg CO_2 eq.	0.00021	0.000020	0.000017	0.000016	INA
ODP	kg CFC11 eq.	1.25E-09	4.65E-10	5.23E-10	2.14E-10	INA
AP	mol H^+ eq.	1.53E-03	2.33E-04	3.13E-04	1.30E-04	INA
EP-freshwater	kg P eq.	2.79E-06	3.79E-07	3.01E-07	2.14E-07	INA
EP-marine	kg N eq.	5.59E-04	9.64E-05	1.32E-04	5.09E-05	INA
EP-terrestial	mol N eq.	5.72E-03	1.05E-03	1.44E-03	5.55E-04	INA
POCP	kg NMVOC eq.	1.61E-03	3.22E-04	4.23E-04	1.67E-04	INA
ADP-M&M	kg Sb eq.	2.35E-07	7.81E-08	1.62E-07	8.10E-08	INA
ADP-fossil	MJ	2.14E+00	4.41E-01	5.10E-01	2.07E-01	INA
WDP	m^3	-2.28E-02	2.25E-03	1.63E-03	9.98E-04	INA

Carbon Crusher Bio-Road USA, Resource use indicators

Indicator	Unit	A1-A3	A4	A5	B2	C4
RPEE	MJ	1.20E+01	8.83E-03	6.44E-03	4.92E-03	INA
RPEM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
TPE	MJ	1.20E+01	8.83E-03	6.44E-03	4.92E-03	INA
NRPE	MJ	2.14E+00	4.41E-01	5.10E-01	2.07E-01	INA
NRPM	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
TRPE	MJ	2.14E+00	4.41E-01	5.10E-01	2.07E-01	INA
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	INA
W	m^3	-4.90E-04	7.45E-05	5.30E-05	3.41E-05	INA

Carbon Crusher Bio-Road USA, biogenic carbon content at the factory gate

Biogenic carbon content	Unit	Value
Biogenic carbon content in product	kg C	1.04E-01
Biogenic carbon content in the accompanying packaging	kg C	0.00E+00

Core indicators applied to Carbon Crusher Bio-Road rehabilitation service over project's estimated service life (ESL)

The LCA results presented in the following tables refer to a functional unit of one square meter for the rehabilitated road over its ESL, 20 years.

Core environmental impact indicators associated with the Carbon Crusher Bio-Road rehabilitation service in Norway

Indicator	Unit	A1-A3	A4	A5	B2	C4
GWP-total	kg CO_2 eq.	-6.93	0.18	0.78	0.27	0.16
GWP-fossil	kg CO_2 eq.	1.59	0.18	0.78	0.26	0
GWP-biogenic	kg CO_2 eq.	-8.53	0.00015	0.0015	0.00052	0.16
GWP-LULUC	kg CO_2 eq.	0.010	0.000089	0.00028	0.000073	0

Core environmental impact indicators associated with the Carbon Crusher Bio-Road rehabilitation service in United States of America

Indicator	Unit	A1-A3	A4	A5	B2	C4
GWP-total	kg CO_2 eq.	-5.96	0.66	0.78	0.33	0.17
GWP-fossil	kg CO_2 eq.	3.36	0.66	0.78	0.33	0
GWP-biogenic	kg CO_2 eq.	-9.32	0.00042	0.000082	-0.000035	0.17
GWP-LULUC	kg CO_2 eq.	0.0041	0.00040	0.00034	0.00031	0

Bibliography

c-PCR Part C: 2019	Rehabilitation of highways, streets and roads. Complementary product category rules (C-PCR) to PCR 2019:14. Version 2021-07-09.
Ecoinvent V3.9. 2022	Ecoinvent version 3.9. Swiss, Centre for Life Cycle Inventories, Dübendorf, Switzerland.
EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declaration - Core rules for the product category of construction products.
European Commission. 2023	European Platform on LCA | EPLCA. EN 15804 reference package. https://eplca.jrc.ec.europa.eu/LCDN/EN15804.xhtml
ISO 14001:2015	Environmental management systems - Requirements with guidance for use.
ISO 14020:2022	Environmental statements and programmes for products - Principles and general requirements. Geneva, Switzerland, International Organization for Standardization.
ISO 14025:2010	Environmental labels and declarations - Type III environmental declarations - Principles and procedures.
ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines.
NPCR PART A: 2021	Construction products and services. Part A version 2.0, March 2021. EPD-Norge.
Silva and Mooselu 2023	OR.22.23. LCA report for EPD verification – Carbon Crusher Bio-Road.

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