

Owner: SR-Gruppen A/S
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3rd PARTY VERIFIED

EPD

VERIFIED ENVIRONMENTAL PRODUCT DECLARATION | ISO 14025 & EN 15804



Owner of declaration

SR-Gruppen A/S
Fuglesangsalle 14
6600 Vejen



Issued:

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Programme

EPD Danmark
www.epddanmark.dk



- ☐ Industry EPD
☒ Product EPD

Declared product(s)

1000 kg of laid BSM Incineration slag pavement, including production and laying.

Number of declared datasets/product variations: 1

Production site

No stationary production facilities are involved. The production of BSM FS is done using movable machinery and takes place close to the site where the road is constructed or close to the site, where incineration slag is sourced from.

Product(s) use

BSM incineration slag is a material used in road construction, mainly as an alternative to conventional asphalt, where it can be used to form the supporting layers beneath the upper asphalt wear layer.

Declared/ functional unit

1000 kg of laid BSM incineration slag pavement.

Year of production site data (A3)

2022

EPD version

First version – Version 1.0

Basis of calculation

This EPD is developed in accordance with the European standard EN 15804+A2.

Comparability

EPDs of construction products may not be comparable if they do not comply with the requirements in EN 15804. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804 and if the background systems are not based on the same database.

Validity

This EPD has been verified in accordance with ISO 14025 and is valid for 5 years from the date of issue.

Use

The intended use of an EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings.

EPD type

- ☐ Cradle-to-gate with modules C1-C4 and D
☒ Cradle-to-gate with options, modules C1-C4 and D
☐ Cradle-to-grave and module D
☐ Cradle-to-gate
☐ Cradle-to-gate with options

CEN standard EN 15804 serves as the core PCR

Independent verification of the declaration and data, according to EN ISO 14025

- ☐ internal ☒ external

Third party verifier:

Mirko Miseljic

Martha Katrine Sørensen
EPD Danmark

Life cycle stages and modules (MND = module not declared)

Product			Construction process		Use							End of life				Beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport	Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Re-use, recovery and recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	X	X	X	X	X

Product information

Product description

The main product components are shown in the table below.

Material	Weight-% of declared product
Incineration slag	95.3%
Cement	0.8%
Water	1.8%
Bitumen	2.1%
Total	100%

Bitumen Stabilized Material Incineration slag (BSM FS) is a material used in road construction, mainly as an alternative to conventional asphalt, where it can be used to form the supporting base course layers beneath the upper asphalt wearing course. BSM FS is a relatively new material on the market in Denmark. Both the material composition and manufacturing process differ from conventional asphalt, as BSM FS consists mainly of incineration slag and is manufactured using a cold mixing process.

BSM FS is made by mixing 95.3% incineration slag with approx. 0.8% cement (adhesive filler), approx. 1.8 % process water and approx. 2.1% bitumen, added as a binder. All materials are mixed in a cold mixing process, and the product (BSM FS) can thereafter be used directly to form the base course layers beneath the upper asphalt wearing course. The properties and load-bearing capacity of BSM with incineration slag lie between gravel base layers and traditional hot-mixed asphalt base layers. BSM FS has similar properties to BSM based on recycled asphalt and therewith an expected durability similar to asphalt, when the BSM layer thickness is increased with about 25% compared traditional hot-mixed asphalt.

Product packaging

No sales- or transport packaging is used for BSM FS, since all materials and products are transported directly on the bed of transportation trucks.

Representativity

This declaration, including data collection and the modelled foreground system including results, represents the production and laying of 1000 kg BSM FS pavement in Denmark by SR-Gruppen. Product specific data are based on average values collected from the year 2022. Background data are based on datasets from the LCA for experts 10.7 database and are less than 5 years old. Generally, the used background datasets are of high quality, and the majority of the datasets are only a couple of years old.

Hazardous substances

The product declared within this EPD (BSM FS pavement) does not contain substances listed on the "Candidate List of Substances of Very High Concern for authorisation"

(<http://echa.europa.eu/candidate-list-table>).

Essential characteristics

BSM FS must comply with the requirements described in AAB for BSM-KMA, which can be found using the following link (Find specific documents under "Asfaltbelægninger" --> "BSM-KMA -AAB/SAB-P"):

<https://vejregler.dk/h/7e0fba84-06dd-483b-898a-c7b3e3affaa1/c4ea4a43d6984ea189b1a6811f973c82?showExact=true>

Further technical information can be obtained by contacting the manufacturer or on the manufacturers website:

<https://www.sr-gruppen.dk/>

Reference Service Life (RSL)

The reference service life is based on information directly from SR-Gruppen, and from their experience with BSM based on recycled asphalt. The lifetime may however differ depending on the road type in which BSM FS is used, but the technical maximum service life of BSM FS is set to 50 years under normal conditions.

Picture of product(s)



LCA background

Declared unit

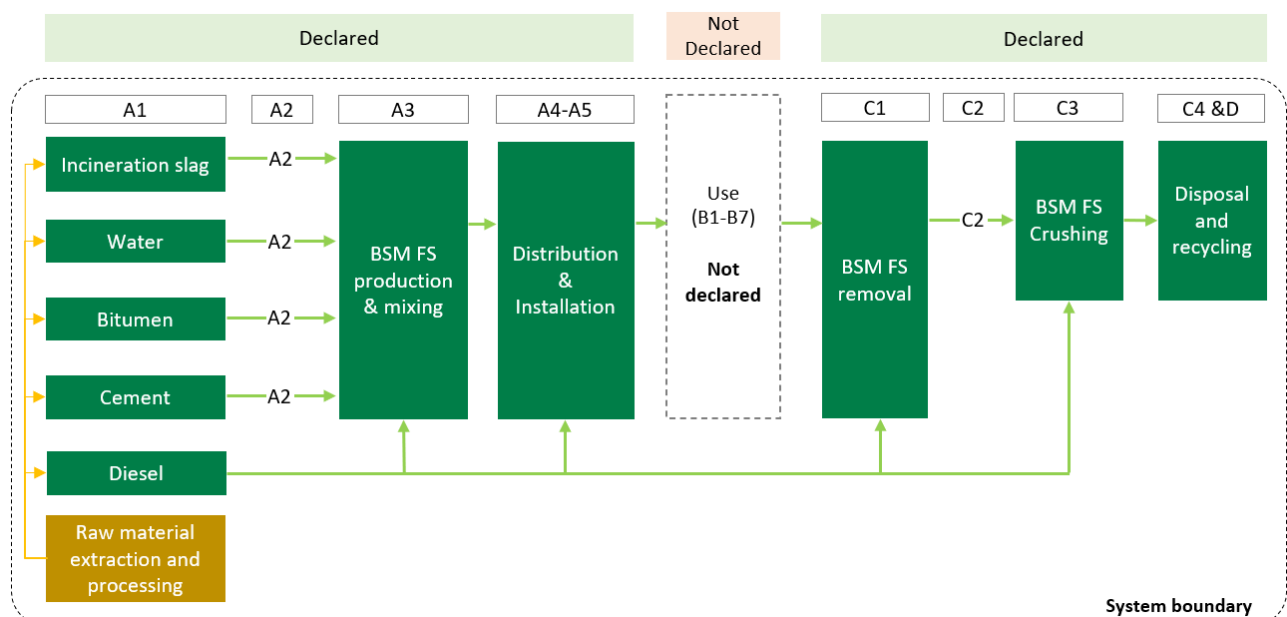
The LCI and LCIA results in this EPD relates to 1000 kg of laid BSM FS pavement.

Name	Value	Unit
Declared unit	1000	kg
Density	NA	NA
Conversion factor to 1 kg.	0.001	-

Functional unit

"Not defined"

Flowdiagram



System boundary

This EPD is based on a "Cradle to gate with options, modules A4-A5, C1-C4, and module D" LCA, in which 100 weight-% has been accounted for.

The general rules for the exclusion of inputs and outputs follow the requirements in EN 15804, 6.3.5, where the total of neglected input flows per module shall be a maximum of 5 % of energy usage and mass and 1 % of energy usage and mass for unit processes.

All activities related to BSM FS production are separated from all other production activities at SR-Gruppen. This means that no allocation of the emissions, energy, and materials used for BSM FS is done, as there are no co-products involved in the manufacturing process. Thus, all materials, energy, and emissions from the production of BSM FS are solely related to BSM FS production.

Product stage (A1-A3) includes:

A1 – Extraction and processing of raw materials

A2 – Transport to the production site

A3 – Manufacturing processes

The product stage comprises the acquisition of all raw materials, products and energy, transport to the production site, packaging and waste processing up to the "end-of-waste" state or final disposal. The LCA results are declared in aggregated form for the product stage, which means, that the sub-modules A1, A2 and A3 are declared as one module A1-A3.

A temporary BSM FS manufacturing site is set up with every new project, close to where the road is constructed. The manufacturing equipment consists of diesel driven and movable machinery. This means that there are no stationary production facilities involved in the manufacturing of BSM FS, and that all equipment is transported to each construction site, or to the site, where incineration slag is sourced from. The raw materials are transported to the mixing/production site (A2), sourced from specific suppliers.

BSM FS is made (A3) by mixing 95.3% incineration slag with approx. 0.8% cement

(adhesive filler), approx. 1.8% process water and approx. 2.1% bitumen, added as a binder in a cold-mixing process. Incineration slag enters the system with negative value for Global Warming Potential. The reason for this is that CO₂ is taken up in the production of incineration slag due to carbonization.

Construction process stage (A4-A5) includes:

Once the BSM FS has been produced, it will be loaded onto trucks and transported to the road construction site. The internal transport on the construction site is undertaken using the same machines which are used in the laying of BSM FS pavement, and therefore the diesel consumption from internal transport in A4 is included in the total diesel consumption for the machines used in A5.

At the road construction site, BSM FS is loaded onto specialized paving machines, and thereafter laid and later compressed using drum rolls, to form the final supporting pavement layer on the road.

Use stage (B1-B7) includes:

Not declared.

End of Life (C1-C4) includes:

The end-of-life scenario used for this study is based on common practice of treating asphalt at the end-of-life in Denmark today. The pavement will be removed from the road (C1), whereafter it will be crushed (C3) and transported back to an asphalt storage facility (C2). When the crushed BSM FS pavement is delivered to the asphalt storage facility, it is no longer considered as waste, since it has now become a new material which can be recycled back into asphalt production once again. It is assumed that material wasted during the crushing of BSM FS is disposed of by landfilling.

Re-use, recovery and recycling potential (D) includes:

In Denmark crushed asphalt/BSM FS will either be recycled back into the production of new asphalt or be used as substitution for natural

aggregates/gravel in construction of unbound base layers.

As a conservative approach, it is assumed that crushed recycled BSM FS will substitute 100% natural aggregates (gravel) in the market. However, since the main input of materials used

in the production of BSM FS is incineration slag, the environmental savings from recycling crushed BSM FS are correspondingly small, as it is only the virgin materials which receive a credit. As incineration slag was used as secondary material in the previous product system, it cannot be credited in the present EPD.

LCA results

ENVIRONMENTAL IMPACTS PER ton BSM FS									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	[kg CO ₂ eq.]	7,11E+00	4,97E+00	6,73E-01	7,79E-01	2,46E+00	1,56E+00	4,37E-01	-8,86E-02
GWP-fossil	[kg CO ₂ eq.]	6,96E+00	4,91E+00	6,64E-01	7,67E-01	2,43E+00	1,53E+00	4,51E-01	-9,05E-02
GWP-bio	[kg CO ₂ eq.]	1,21E-01	1,45E-02	3,60E-03	4,17E-03	7,19E-03	8,33E-03	-1,50E-02	2,20E-03
GWP-luluc	[kg CO ₂ eq.]	2,16E-02	4,55E-02	5,95E-03	6,88E-03	2,26E-02	1,38E-02	1,40E-03	-3,87E-04
ODP	[kg CFC 11 eq.]	1,68E-11	6,39E-13	8,36E-14	9,66E-14	3,17E-13	1,93E-13	1,15E-12	-5,81E-13
AP	[mol H ⁺ eq.]	5,89E-02	5,86E-03	8,92E-03	1,03E-02	3,56E-03	2,06E-02	3,20E-03	-4,61E-04
EP-fw	[kg PO ₄ eq.]	1,99E-05	1,79E-05	2,35E-06	2,72E-06	8,91E-06	5,43E-06	9,08E-07	-4,53E-07
EP-mar	[kg N eq.]	1,98E-02	1,90E-03	4,03E-03	4,66E-03	1,29E-03	9,32E-03	8,26E-04	-1,63E-04
EP-ter	[mol N eq.]	2,17E-01	2,31E-02	4,43E-02	5,13E-02	1,53E-02	1,03E-01	9,09E-03	-1,80E-03
POCP	[kg NMVOC eq.]	6,73E-02	5,03E-03	1,31E-02	1,51E-02	3,12E-03	3,02E-02	2,49E-03	-4,43E-04
ADP-mm ¹	[kg Sb eq.]	9,90E-07	3,23E-07	4,23E-08	4,89E-08	1,60E-07	9,78E-08	2,08E-08	-9,38E-09
ADP-fos ¹	[MJ]	9,41E+02	6,69E+01	8,75E+00	1,01E+01	3,32E+01	2,02E+01	6,00E+00	-1,40E+00
WDP ¹	[m ³]	9,76E-01	5,93E-02	7,76E-03	8,98E-03	2,94E-02	1,80E-02	4,95E-02	-9,59E-03
Caption	GWP-total = Global Warming Potential - total; GWP-fossil = Global Warming Potential - fossil fuels; GWP-bio = Global Warming Potential - biogenic; GWP-luluc = Global Warming Potential - land use and land use change; ODP = Ozone Depletion; AP = Acidification; EP-freshwater = Eutrophication - aquatic freshwater; EP-marine = Eutrophication - aquatic marine; EP-terrestrial = Eutrophication - terrestrial; POCP = Photochemical zone formation; ADPm = Abiotic Depletion Potential - minerals and metals; ADPf = Abiotic Depletion Potential - fossil fuels; WDP = water use								
Disclaimer	¹ The results of this environmental indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.								

ADDITIONAL ENVIRONMENTAL IMPACTS PER ton BSM FS									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	[Disease incidence]	1,08E-06	4,70E-08	3,58E-07	4,14E-07	3,07E-08	8,28E-07	3,93E-08	-2,70E-08
IRP ²	[kBq U235 eq.]	2,94E-01	1,87E-02	2,45E-03	2,83E-03	9,30E-03	5,67E-03	7,91E-03	-1,58E-02
ETP-fw ¹	[CTUe]	6,97E+02	4,75E+01	6,23E+00	7,21E+00	2,36E+01	1,44E+01	3,27E+00	-7,76E-01
HTTP-c ¹	[CTUh]	1,36E-08	9,72E-10	1,27E-10	1,47E-10	4,82E-10	2,94E-10	5,04E-10	-6,01E-11
HTTP-nc ¹	[CTUh]	6,29E-07	5,17E-08	1,23E-08	1,42E-08	2,57E-08	2,84E-08	5,54E-08	-5,88E-09
SQP ¹	-	2,16E+01	2,79E+01	3,66E+00	4,23E+00	1,39E+01	8,46E+00	1,46E+00	-4,74E-01
Caption	PM = Particulate Matter emissions; IRP = Ionizing radiation - human health; ETP-fw = Eco toxicity - freshwater; HTTP-c = Human toxicity - cancer effects; HTTP-nc = Human toxicity - non cancer effects; SQP = Soil Quality (dimensionless)								
Disclaimers	¹ The results of this environmental 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 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.								

RESSOURCE CONSUMPTION PER ton BSM FS									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	[MJ]	1,50E+01	4,87E+00	6,37E-01	7,36E-01	2,41E+00	1,47E+00	9,78E-01	-4,55E-01

PERM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,50E+01	4,87E+00	6,37E-01	7,36E-01	2,41E+00	1,47E+00	9,78E-01	-4,55E-01
PENRE	[MJ]	1,58E+02	6,71E+01	8,78E+00	1,02E+01	3,33E+01	2,03E+01	6,01E+00	-1,40E+00
PENRM	[MJ]	7,94E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	9,41E+02	6,71E+01	8,78E+00	1,02E+01	3,33E+01	2,03E+01	6,01E+00	-1,40E+00
SM	[kg]	9,54E+02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m³]	2,85E-02	5,33E-03	6,98E-04	8,07E-04	2,64E-03	1,61E-03	1,52E-03	-4,16E-04
Caption	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 material; RSF = Use of renewable secondary fuels; NRSF = Use of non renewable secondary fuels; FW = Net use of fresh water								

WASTE CATEGORIES AND OUTPUT FLOWS PER ton BSM FS									
Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	[kg]	3,52E-09	2,08E-10	2,72E-11	3,14E-11	1,03E-10	6,29E-11	1,31E-10	3,42E-11
NHWD	[kg]	1,50E-01	1,02E-02	1,34E-03	1,55E-03	5,08E-03	3,10E-03	3,00E+01	-1,88E+00
RWD	[kg]	2,15E-03	1,26E-04	1,64E-05	1,90E-05	6,23E-05	3,80E-05	6,85E-05	-9,65E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,70E+02	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	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	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	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy								

BIOGENIC CARBON CONTENT PER ton BSM FS		
Parameter	Unit	At the factory gate
Biogenic carbon content in product	kg C	0.00E+00
Biogenic carbon content in accompanying packaging	kg C	0.00E+00

Additional information

LCA interpretation

The raw materials (module A1) are the main contributor across the majority of impact categories. The results indicate that the manufacturing of bitumen stands for 20% to 82% of the overall impacts across all impact categories considered. This seems remarkable as the input of bitumen solely amounts to 2% of the overall raw material input. Other dominating processes across categories are the raw material cement and the incineration of diesel for transporting raw materials as well as heavy machinery to the respective production and laying site.

Technical information on scenarios

Transport to the building site (A4)

Scenario information	Value	Unit
Fuel type	Diesel	-

Vehicle type	Trucks	-
Transport distance	19	km
Capacity utilisation (including empty runs)	50	%
Gross density of products transported	N/A	kg/m ³
Capacity utilisation volume factor	N/A	-

Installation of the product in the building (A5)

Scenario information	Value	Unit
Ancillary materials	0	kg
Water use	0	m ³
Other resource use	0	kg
Energy type and consumption	0.22	Liter diesel per ton BSM FS
Waste materials	0	kg
Output materials	0	kg
Direct emissions to air, soil or water	0	kg

Reference service life

RSL information		Unit
Reference service Life	50	Years
Declared product properties	Information for all topics can be found on the company's website, by using the following link: https://www.sr-gruppen.dk/	
Design application parameters		
Assumed quality of work		
Outdoor environment		
Indoor environment		
Usage conditions		
Maintenance		

End of life (C1-C4)

Scenario information	Value	Unit
Collected separately	1000	kg
Collected with mixed waste	0	kg
For reuse	0	kg
For recycling	970	kg
For energy recovery	0	kg
For final disposal	30	kg
Assumptions for scenario development	N/A	As appropriate

Re-use, recovery and recycling potential (D)

Scenario information/Materiel	Value	Unit
Crushed BSM FS pavement can replace natural aggregates (Gravel) in the market.	970	kg

Indoor air

The EPD does not give information on release of dangerous substances to indoor air because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.1.

Soil and water

The EPD does not give information on release of dangerous substances to soil and water because the horizontal standards on the relevant measurements are not available. Read more in EN15804+A1 chapter 7.4.2.

References

Publisher	 epddanmark www.epddanmark.dk <small>Template version 2023.1</small>
Programme operator	Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup www.teknologisk.dk
LCA-practitioner	Daniel Matthaeus Krisa Danish Technological Institute Buildings & Environment Gregersensvej DK-2630 Taastrup www.teknologisk.dk
LCA software / background data	Thinkstep LCA for experts version 10.7.0.183, 2023 including databases https://sphaera.com/ <i>EN 15804 reference package 3.1</i>
3rd party verifier	Mirko Miseljic FORCE Technology Park Alle 345 DK-2605 Brøndby www.forcetechnology.com

General programme instructions

General Programme Instructions, version 2.0, spring 2020
www.epddanmark.dk

EN 15804

DS/EN 15804 + A2:2019 - "Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products"

EN 15942

DS/EN 15942:2011 – " Sustainability of construction works – Environmental product declarations – Communication format business-to-business"

ISO 14025

DS/EN ISO 14025:2010 – " Environmental labels and declarations – Type III environmental declarations – Principles and procedures"

ISO 14040

DS/EN ISO 14040:2008 – "Environmental management – Life cycle assessment – Principles and framework"

ISO 14044

DS/EN ISO 14044:2008 – "Environmental management – Life cycle assessment – Requirements and guidelines"