Environmental Product Declaration Type III ITB No. 337/2022

Issuance date: 15.06.2022
Validity date: 15.06.2027

Fortifix® -
Steel-based crack-preventing asphalt reinforcement

EPD Program Operator:

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ITB is the verified member of The European Platform for EPD program operators and LCA practitioner www.eco-platform.org

Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment. Their aspects were verified by the independent body according to ISO 14025. Basically, a comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804 (see point 5.3 of the standard).

Life cycle analysis (LCA): A1-A4, C1-C4 and D modules in accordance with EN 15804
(Cradle to Gate with options)
The year of preparing the EPD: 2022
Service Life: not declared by producer
PCR: ITB-PCR A (PCR based on EN 15804)
Declared unit: 1 kg of product
Product Standards: EN 15381
Reasons for performing LCA: B2B
Representativeness: manufactured in Slovakia, year 2021

PRODUCTS DESCRIPTION

Bekaert (www.bekaert.com) is a global producer of steel wire reinforcement solutions for a wide range of applications. Fortifix® is a steel-based anti-reflective cracking interlayer solution covered by this EPD and is produced in the manufacturing plant located at Hlohovec, Slovakia. The mesh grid is built up from steel cords in longitudinal and cross direction, the steel cords are stitched to a carrier. Fortifix® 1-C & 2-C: with Closed carrier – PET non-woven (Fortifix® 1-C: highest steel density, Fortifix® 2-C: lowest steel density). The advanced steel cord structure is combined with a light-weight non-woven to provide optimal stability during the overlay process preventing rucking and pushing under site traffic. Figure 1 shows an application overview for Fortifix®.

Figure 1. Fortifix® installation in a road structure

Specific product technical data is available at the manufacturer's website, Bekaert.com.

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Unit

The declared unit is 1 kg of Fortifix®. In order to convert the results of the environmental assessment from kilogram to square meter, the equivalence factors given in Table 4 should be used.

System boundary

The life cycle analysis of the declared product covers "Product Stage" A1-A3 modules, "transport to site" A4, "End of Life stage" C1, C2, C3, C4 modules and gains and loads beyond system in D module (Cradle to Gate with options) in accordance with EN 15804 and ITB PCR A.

Allocation

The allocation rules used for this EPD are based on general ITB PCR A. Production of Fortifix® is a line process in a manufacturing plant located at Hlohovec, Slovakia (see Figure 2). Allocation of impacts is done on product mass basis where no specific allocation for Fortifix® production based on manufacturer information was provided. All impacts from raw materials production (wire rod, yarns, non-woven, WWD lubricants, HCl, Inhibitor, nitrogen, Zn blocks, foil, pallets) are allocated in A1 module of the LCA. Minimum 99% of the impacts from a line production were allocated to the product covered by this declaration. Module A2 includes product specific (100%) transport of raw materials such as steel (and other) from supplier to manufacturing plant (Hlohovec). Municipal wastes of the factory were allocated to module A3 (mass allocation). Specific energy use and electricity (ZSE) was inventoried and 100% was allocated to the product assessed. Emissions in the factory are assessed using Ecoinvent data for energy carriers.

System limits

Minimum 99% input materials and 100% energy consumption (electricity, gas) were inventoried in the factory and were included in the calculation. In the assessment, all significant parameters from gathered production data are considered, i.e. all material used per formulation (main input is steel Wire Rod), utilized thermal energy, and electric power consumption, direct production waste and available emission measurements. Tires consumption for transport was not taken into account. Substances with a percentage share of less than 1% of total mass (borax, serdet, anthractite, salt, vermiculite) were excluded from the calculations. It is assumed that the total sum of omitted processes does not exceed 0,5% of all impact categories. In accordance with EN 15804 machines (for example Widia Dies) and facilities (capital goods) required for and during production are excluded, as is transportation of employees.

A1 and A2 Modules: Raw materials supply and transport

The steel (EAF, low alloyed) and other input materials (impacts) are declared based on valid Ecoinvent data. Data on transport of the different input products to the manufacturing plants were inventoried in detail and modelled by the assessor. For calculation purposes, European fuel averages are applied in module A2.

A3: Production

The product specific production process (Hlohovec plant) is presented in Figure 2.

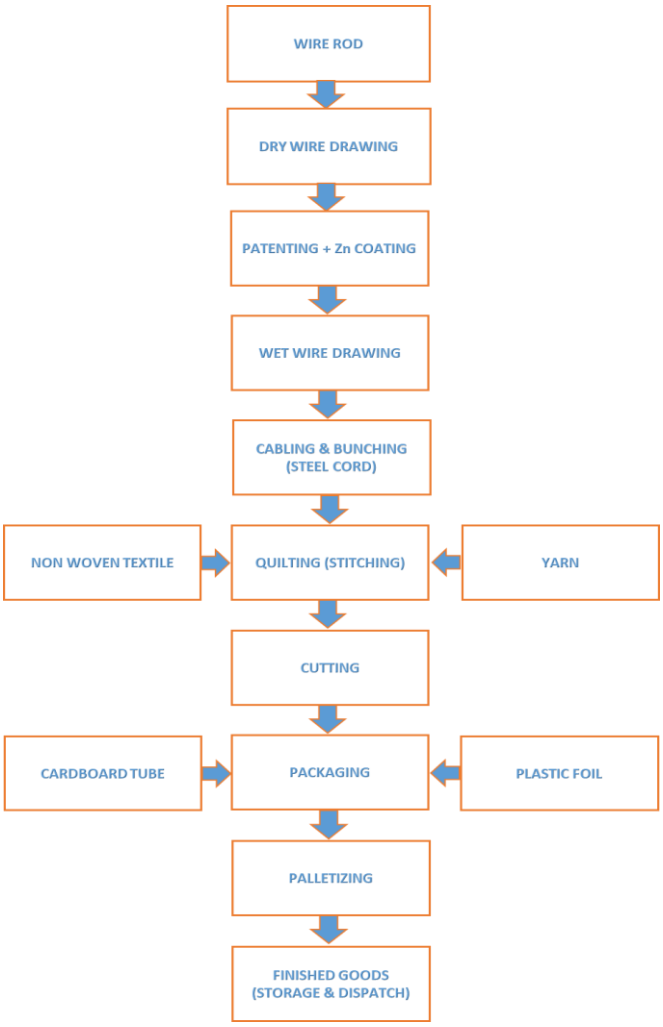

Figure 2. A schematic diagram of the industrial process (A3 module)

A4: Transport to construction site

The following transport scenario to the place of use was assumed based on the manufacturer's declaration: large vehicle, 75% capacity over an average distance of 500 km. For calculation purposes, European fuel averages are applied in module A4.

End of life scenarios (C and D modules)

The end-of-life scenario has been generalized. The asphalt with the Fortifix® is disassembled (C1 module) by grappling hooks mounted onto heavy equipment and collected mechanically. 95% material recovery during demolishing was assumed. The manufacturer declares the technology and the scenario in which the Fortifix® can be separated from waste up to 95%. 5% goes to a landfill. Scrap steel can be used for new steel production (EAF process). It is assumed that at the end of life the transport distance from the product deconstruction place to waste processing (C2) is 50 km on > 16 t loaded lorry with 75% capacity utilization and fuel consumption of 35 l per 100 km. Materials recovered from dismantled products are recycled according to the BAT treatment practice. The reuse, recovery and recycling potential for a new product system is considered beyond the system boundaries (module D), based on World Steel recommendations and national practice.

Table 1. End of life scenarios for Fortifix® products

Progress products	**Material recovery from Road**		**Landfilling**
Steel products	95%	→ 100% Recycling	5%

Data collection period

The data of manufacturing of the declared products refer to period between 01.01.2021 – 31.12.2021 (1 year). The life cycle assessments were done for Slovakia as reference area.

Data quality - production

The values determined to calculate A3 originate from verified Progress LCI inventory data. A1 values were prepared considering steel products characteristics based on Ecoinvent data. Allocation for steel production impacts is done in accordance with *LCI data for Steel products Report* compiled by Brayan Hughes and William Hare (2012 for World Steel Association).

Assumptions and estimates

The impacts of the representative product were aggregated using a weighted average where there was no option to separate the impacts on the Fortifix® production process. The mass inter-branch flows were taken into account. All production processes (A3) at Hlohovec plant were assigned to different types of products based on the information provided by manufacturer in LCI. Fortifix® 1-C and Fortifix® 2-C are impact averaged.

Calculation rules

LCA was done in accordance with ITB PCR A document. Characterization factors are CML ver. 4.2 based. ITB-LCA algorithms were used for impact calculations. A1 was calculated based on data from the database, A3 and A2 are calculated based on the LCI questionnaire provided by the manufacturer.

Databases

The background data for the processes come from the following databases: Ecoinvent v.3.8 (steel, zinc, nitrogen, HCl, WWD, ancillary items, packaging) and ZSE (Slovak electricity mix and combustion factors for fuels). Specific (LCI) data quality analysis was a part of the audit. The time related quality of the data used is valid (5 years).

Additional information

Specific CO_2 emissions, related to the total electricity supplied to the Slovak electricity system, reached the historically lowest level in 2021 thanks to a balanced energy mix with a high share of electricity production from nuclear and hydro power plants and a lower supply from thermal power plants burning fossil fuels, while decreasing by more than 20% year on year. Slovak electricity mix used is 0.107 kg CO_2/kWh.

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to the unit DU – 1 kg of the Fortifix® (Table 3). The following life cycle modules are included in the declaration (Table 2).

Table 2. System boundaries (life stage modules included) in a product environmental assessment

Environmental assessment information (MA – Module assessed, MNA – Module not assessed, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction 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**
MA	**MA**	**MA**	**MA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MNA**	**MA**	**MA**	**MA**	**MA**	**MA**

Table 3. Environmental product characteristic – 1 kg of Fortifix®

Environmental impacts: (DU) 1 kg										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Global warming potential	kg CO_2	1.46E+00	2.55E-02	2.69E-01	5.25E-02	2.52E-03	3.20E-03	1.68E-03	1.92E-03	-2.11E-01
Depletion potential of the stratospheric ozone layer	kg CFC 11	1.38E-07	4.58E-08	1.20E-08	6.00E-08	2.89E-11	1.28E-08	1.92E-11	7.68E-09	-1.44E-08
Acidification potential of soil and water	kg SO_2	1.18E-02	1.35E-04	1.45E-03	4.16E-04	2.31E-06	2.21E-05	1.53E-06	1.32E-05	-8.36E-04
Formation potential of tropospheric ozone	kg Ethene	2.34E-03	3.90E-06	8.46E-05	2.67E-05	1.19E-05	1.48E-06	7.94E-06	8.91E-07	-3.80E-05
Eutrophication potential	kg $(PO_4)^{3-}$	2.81E-03	1.50E-05	4.14E-04	7.38E-05	9.61E-08	3.90E-06	6.39E-08	2.34E-06	-4.56E-04
Abiotic depletion potential (ADP-elements) for non-fossil resources	kg Sb	9.27E-04	8.88E-08	2.59E-03	1.10E-08	1.94E-05	3.23E08	1.29E-05	6.00E-05	-1.29E-04
Abiotic depletion potential (ADP-fossil fuels) for fossil resources	MJ	2.86E+01	4.06E-01	5.10E+00	7.17E-01	3.00E-02	3.92E-02	2.00E-02	2.35E-02	-2.25E+00
Environmental aspects: (DU) 1 kg										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	6.29E+00	6.00E-03	1.23E+00	4.50E-03	3.92E-04	2.99E-03	2.35E-04	3.83E-01	-4.50E-03
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Use of non-renewable primary energy resources used as raw materials	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ	3.27E+01	4.14E-01	8.63E+00	3.30E-02	4.12E-02	2.19E-02	2.47E-02	3.32E+00	-3.30E+00
Use of secondary material	kg	3.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E-02	1.01E-01
Use of renewable secondary fuels	MJ	7.99E-05	7.50E-04	0.00E+00	0.00E+00	2.06E-03	0.00E+00	1.24E-03	4.20E-04	-4.00E-04
Use of non-renewable secondary fuels	MJ	6.47E-06	8.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water	m^3	1.59E-01	7.50E-05	2.78E-03	9.48E-06	4.20E-07	6.30E-06	2.52E-07	9.88E-04	-9.48E-06
Other environmental information describing waste categories: (DU) 1 kg										
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	3.78E-02	1.01E-06	3.65E-06	4.64E-06	4.00E-08	1.51E-06	2.66E-08	9.06E-07	-2.17E-06
Non-hazardous waste disposed	kg	1.61E+00	1.80E-02	7.13E-03	5.51E-03	3.61E-04	1.79E-03	5.02E-02	1.08E-03	-1.66E-01
Radioactive waste disposed	kg	6.91E-05	2.40E-06	4.41E-06	0.00E+00	4.00E-08	0.00E+00	2.66E-08	0.00E+00	-1.79E-05
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-02	0.00E+00	-8.01E-04
Materials for recycling	kg	9.52E-05	0.00E+00	7.00E-02	0.00E+00	0.00E+00	0.00E+00	9.55E-01	0.00E+00	-7.03E-06
Materials for energy recover	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	0.00E+00
Exported energy	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	0.00E+00

RESULTS INTERPRETATION

The environmental impact of Fortifix® product (cradle to gate with options) is largely dependent on the energy-intensive production of steel (half product) on which the manufacturer has a limited influence. The carbon impact of steel production (Wire Rods) in the product stage A1 is almost 50%. The second element with the greatest impact on the result is non-woven material with the impact almost 30% of A1. The impact of the production line A3 largely depends on the gas and electricity consumed for the drawing and coating process by the manufacturing plant (8.6 MJ/kg of product). The share of impacts from energy in the production phase is about 10%. The LCA results show that the cradle-to-gate carbon (Global Warming Potential) impact of 1 kg of *Fortifix®* production is 1.76 kg CO_2eq. For comparison, a ton of steel produced worldwide in 2020 emitted on average 1.85 tons of carbon dioxide. The products have a high recycling potential (95%) and a noticeable D module (benefit to other product systems) potential. Fortifix® is almost cradle-to-cradle. Steel can be extracted from the milled asphalt at the asphalt plants. This extracted steel can be recycled without any quality loss.

Note: Due to the fact that different types of Fortifix® differ in the amount of mass, the possibility of using Global warming potential (GWP) multipliers (conversion factor) for each specific product type was introduced. In order to convert the results of the environmental assessment from kilogram to square meter, the equivalence factors given in Table 4 should be used.

Table 4. Global warming potential per Fortifix® types.

Type	Roll width m	Equivalence factors m^2 / Kg	Global warming potential Kg CO_2 / Kg of Fortifix
Fortifix® 1-C	1	3.15	2.06
	1.5	3.01	2.06
	2	2.97	2.05
	3	2.93	2.05
Fortifix® 2-C	1	4.43	1.46
	1.5	4.25	1.46
	2	4.08	1.47
	3	4.09	1.47

VERIFICATION

The process of verification of this EPD was in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (sub clause 8.1.3.) [X] external internal [ ]
External verification of EPD: Ph.D. Eng. Halina Prejzner LCA. LCI audit and input data verification: Ph.D, D.SC.Eng. Michał Piasecki. m.piasecki@itb.pl Verification of LCA: Ph.D. Eng. Justyna Tomaszewska. j.tomaszewska@itb.pl

dr hab. inż. Michał Piasecki

KIEROWNIK
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dr inż. Agnieszka Winkler-Skalna

Normative references

- ITB PCR A General Product Category Rules for Construction Products
- EN 15381: 2008 Geotextiles and geotextile-related products - Characteristics required for use in pavements and asphalt overlays
- LCI DATA FOR STEEL PRODUCTS at https://www.worldsteel.org/en/dam/jcr:04f8a180-1406-4f5c-93ca-70f1ba7de5d4/LCI%2520study_2018%2520data%2520release.pdf
- ISO 14025:2006. Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- EN 15804 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- https://www.seas.sk/co2-emissions

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CERTIFICATE № 337/2022
of TYPE III ENVIRONMENTAL DECLARATION

Product:

Fortifix®- Steel-based crack-preventing asphalt reinforcement

Manufacturer:

N.V.Bekaert S.A.

Bekaertstraat 2, 8550 Zwevegem, Belgium

Produced in manufacturing plant:

Bekaert Hlohovec

Mierová 2317, SK-92028, Slovakia

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued for the first time on 15th June 2022 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

Deputy Director for Research and Innovation
Krzysztof Kuczyński, PhD

Warsaw, June 2022