ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	voestalpine AG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-VRS-20210080-ICC1-EN
Issue date	01.07.2021
Valid to	30.06.2026

Concrete turnout sleeper

TSF-A GmbH

www.ibu-epd.com | https://epd-online.com

1. General Information

TSF-A GmbH	Concrete turnout sleeper
Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** voestalpine AG voestalpine-Straße 3 4020 Linz Austria
Declaration number EPD-VRS-20210080-ICC1-EN	**Declared product / declared unit** 1 linear metre (lm) of concrete turnout sleeper with an average weight of 169 kg/lm and a volume of 0,065 m³.
This declaration is based on the product category rules: Pre-cast concrete components, 30.11.2017 (PCR checked and approved by the SVR)	**Scope:** This EPD is based on a declared unit of 1 linear metre (lm) of average concrete turnout sleeper, produced at the site TSF-A GmbH, Sollenau (Austria).
Issue date 01.07.2021	The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences. The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.
Valid to 30.06.2026	**Verification** The standard *EN 15804* serves as the core PCR Independent verification of the declaration and data according to *ISO 14025:2010* ☐ internally ☒ externally
Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))	Dr.-Ing. Andreas Ciroth (Independent verifier)

2. Product

2.1 Product description/Product definition

TSF-A GmbH (Turnout Sleeper Factory-Austria) was founded in 2008 as a joint venture between Kirchdorfer Fertigteilholding GmbH and voestalpine Turnout Technology Zeltweg GmbH.

Thanks to the decades of experience of both companies in the respective specialist area of railway infrastructure business - the development and production of concrete turnout sleepers and the provision of complete turnout systems - the concrete turnout sleepers can be optimized and further developed in the overall system.

With the founding of voestalpine Railway Systems GmbH in 2020, TSF-A is now part of the world's leading provider of system solutions for rail infrastructure.

TSF-A offers different types of high quality, prestressed concrete turnout sleepers, optionally with under sleeper pads and fastening systems.

The declared products are prestressed concrete parts of different size and design for use as concrete turnout sleepers. The concrete turnout sleepers support and keep the rails and turnout components in the correct position and transfer the loads to the track superstructure.

The concrete consists of
• prestressed steel,
• cement (hydraulic binder),
• sand and gravel of different grain sizes (aggregates)
• water and
• admixtures and additives.

Cast-in plastic parts of a dowel fastener form the anchor for attaching the rail fastening systems. Depending on the design of the fastening system, additional reinforcement elements such as end brackets or dowel reinforcements made of steel are required.
Depending on the requirements, the concrete turnout sleepers may be alternatively supplied pre-assembled with under sleeper pads, ribbed base plates or fastening material for rails.
A possible pre-assembly takes place in a separate work step within the plants and is not taken into account in this EPD.

The basic geometry of the turnout sleeper can vary in height, width and design.

The declared products are manufactured and delivered in accordance with the applicable European and international standards, guidelines and various customer specifications.

For the use and application of the product the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

2.2 Application

The declared prestressed concrete turnout sleepers of voestalpine Railway Systems GmbH are mainly used in the following types of railway traffic:

- High-Speed Traffic
- Mixed Traffic (passenger and freight traffic)
- Urban Traffic (Metro and Tram).

2.3 Technical Data

This EPD refers to the declared prestressed concrete turnout sleepers of TSF-A.

Technical data

Name	Value	Unit
Gross density	2550	kg/m^3
Compressive strength according to ÖNORM B 4710-1	-	N/mm^2

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking).

2.4 Delivery status

The concrete turnout sleepers are produced and delivered in different lengths according to customer requirements. The sleeper height varies between 160 and 240 mm. The pre-stressed turnout concrete sleepers are optionally eqipped with under sleeper pads, preassembled ribbed baseplates and / or fastening systems. Delivery to the customer is on a just-in-time basis, as required.

2.5 Base materials/Ancillary materials

The concrete turnout sleeper consists of prestressed steel (2-3 m%) and concrete (97-98 m%), which is composed of sand and gravel, water, cement, admixtures and additives. All information regarding the composition relate to the weighted average. The actual composition varies with the intended area of use and the requirements of the customer.

This product contains substances listed in the candidate list (02.12.2020) exceeding 0.1 percentage by mass: no.

This product contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass: no.

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) *Ordinance on Biocide Products* No. 528/2012): no.

2.6 Manufacture

The concrete is made of gravel and sand (aggregates), water, cement (hydraulic binder), admixtures and additives.
Plastic dowels are fixed in the formwork liner and the prestressed steel is clamped. The concrete is then transported from the central mixing plant to the respective formwork line employing a bucket conveyor. A concreting machine fills the formwork line with the concrete. If necessary, the under sleeper pads are then directly applied to the bottom of the sleepers. After the required hardening time of the concrete, with the requirement that the minimum compressive strength has been reached, the concrete turnout sleepers are demoulded and cut to the required lengths defined in advance in the liner plan. Subsequently, the sleepers are placed in an intermediate storage area on the production site. The concrete turnout sleepers are manufactured in a closed building at room temperature.

2.7 Environment and health during manufacturing

The TSF-A production facility is certified according to *ISO 9001* and *ISO 14001*.
Investments in environmental protection measures are constantly being made at the locations. All legal regulations and emission limit values are fulfilled.

2.8 Product processing/Installation

The processing and assembling of the declared products take place in the factory or directly at the installation site of the turnout. The installation is carried out in accordance with the applicable standards, guidelines and specifications of the customers.

2.9 Packaging

The concrete turnout sleepers are stacked on squared timber for transport without packaging, secured with tension belts and then delivered to the customer by rail or, in exceptional cases, by truck.
All materials used for transport can be reused for further deliveries.

2.10 Condition of use

When the concrete turnout sleepers are in use, no changes in the quality of the material are to be expected if they are used as intended. The maintenance and inspection requirements are based on the applicable standards, guidelines and specifications of the end customers.

2.11 Environment and health during use

No effects on human or animal health or harmful emissions into the air, soil or water are to be expected during the use of the concrete turnout sleepers.

2.12 Reference service life

When used as intended, the lifespan of the declared products is based on the applicable standards. Depending on the exposed weather conditions, the expected operating life is 40 to 50 years.

2.13 Extraordinary effects

Fire

Concrete turnout sleepers are "non-flammable". No toxic gases and vapours can arise.

Fire protection

Name	Value
Building material class	n.a.
Burning droplets	n.a.
Smoke gas development	n.a.

Water
Normal concrete does not change under the influence of water (e.g. floods). In particular, there is no leaching of substances that may be hazardous to water or the environment.

Mechanical destruction
In the case of mechanical overload (e.g. impact stress), the concrete turnout sleeper can be destroyed, but no negative consequences for the environment are to be expected.

2.14 Re-use phase
Prestressed concrete turnout sleepers from a possible dismantling can be processed, classified, assessed and reused for subordinate purposes.

2.15 Disposal
After the concrete turnout sleepers have been dismantled and separated into broken concrete and scrap steel, both material fractions can be recycled. The resulting broken concrete can, after appropriate treatment, be used as a material in road and path construction, the steel scrap as part of the secondary production of metal products.
The waste codes according to the *European waste catalogue* are:

10 13 14 - concrete waste and concrete slurry
17 04 05 - iron and steel

2.16 Further information
Further information on the products and the different types of sleepers is available on the website https://www.tsf-a.eu/.

3. LCA: Calculation rules

3.1 Declared Unit
This environmental product declaration refers to a declared unit of 1 linear metre (lm) average WS 220 concrete turnout sleeper with a weight of 169 kg/lm and a volume of 0,065 m³.

Declared unit

Name	Value	Unit
Declared unit	1	lm
conversion factor [Mass/Declared Unit] (in kg/m³)	169	-
Mass reference	169	kg/lm
Gross density	2550	kg/m³
Volume	0.065	m³

At the production site of TSF-A in Sollenau (Austria) various types of concrete turnout sleepers are produced. The calculation of the average follows a volume-weighted approach. Therefore the weighted average was formed based on the different weights per metre of the products and total production quantity. This also applies to the reference thickness of WS 220.

3.2 System boundary
The life cycle assessment of concrete turnout sleepers refers to a *cradle-to-gate* analysis with modules. Subsequent life cycle phases are part of the analysis:

Module A1-A3 | Production stage
The production stage includes the upstream burdens of raw material supply (concrete, aggregates, sand, water, prestressing steel, etc.), their transports and the manufacturing at the production site of TSF-A GmbH located at Sollenau, Austria. The production site is supplied with electricity from the regional power grid and thermal energy from natural gas. The prestressing steel is delivered from upstream organisations which are part of voestalpine group. Thus, the upstream environmental impact of the steel supplied is represented by primary data of the respective production sites.

Module C1 | Deconstruction and demolition
Energy demand for the deconstruction of the sleepers from the track (e.g. loosening of screws) is strongly dependent on the conditions at site and considered to be negligible. This results in a declaration of “0” in module C1.

Module C2 | Transport to disposal
The transport to the disposal of the material is estimated declaring a 50 km radius to the waste processing. This scenario may vary depending on the actual location of deconstruction and referring waste treatment.

Module C3 | Waste processing
The declared scenario assumes the processing of the sleepers in a concrete breaker. Therefore, a loss rate from waste processing of 5 % is assumed. Referring environmental impacts are accounted for in module C4. The separated material fractions of steel and concrete are further recycled.

Module C4 | Disposal
Module C4 refers to the emissions from the disposal of the losses from waste processing. The chosen scenario, therefore, includes the environmental burdens of landfilling of 5 % of the material.

Module D | Benefits and loads beyond the system boundary
Module D declares the recycling of the recovered steel and concrete (95 % of the product). It includes the potential for substituting primary steel and gravel.

3.3 Estimates and assumptions
Assumptions and approximations are applied in case of a lack of representative data. All assumptions are documented precisely and represent a best-guess representation of reality based on the available data.

3.4 Cut-off criteria
The LCA model covers all available input and output flows, which can be represented based on robust data. Data gaps are filled with conservative assumptions

from average data (when available) or with generic data and are documented accordingly. Only data with a contribution lower than 1 % were cut off. Thus, no data were neglected, of which a substantial impact is to be expected. All relevant data were collected comprehensively. Cut-off material and energy flows were chosen carefully based on their expected quantitative contribution as well as potential environmental impacts. Thus, it can be assumed that the sum of all neglected input flows does not account for more than 5 % of the total material, water and energy flows. Environmental impacts from the production of machines and infrastructure were not taken into account.

3.5 Background data

This study uses generic background data for the evaluation of upstream environmental impacts from *GaBi*-databases as well as supplier-specific data where possible.

3.6 Data quality

Data collection is based on product-specific questionnaires. It follows an iterative process clarifying questions via e-mail, telephone calls or in web-meetings. Intensive discussions between voestalpine and Daxner & Merl results in an accurate mapping of product-related material and energy flows. This leads to a high quality of foreground data collected. Data collection relies on a consistent process according to *ISO 14044*.

The technological, geographical and time-related representativeness of the database was kept in mind when selecting background data. Whenever specific data weremissing, either generic datasets or representative average data were used instead. The implemented *GaBi* background datasets refer to the latest versions available (not more than ten years old) and are carefully chosen. The only exception represents the *ISOPA* dataset used for the approximation of the flow agent (11 years).

3.7 Period under review

The life cycle inventory data of TSF-A were collected for the year 2019. The data are based on the volumes produced on an annual basis.

3.8 Allocation

The upstream supply chain of prestressing steel is covered by primary data of the referring production sites. Environmental impacts between the product and the co-products at the integrated steel mill in Donawitz are allocated based on the "*partitioning* approach" developed by worldsteel. Thus, the allocation is based on physical relationships. Scrap used for the production is considered as burden-free input material.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

The *GaBi* background database was used to calculate the LCA (GaBi 10; 2020.2).

4. LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon
The declared product does not contain any biogenic carbon.

End of life (C1-C4)

Name	Value	Unit
Collected separately (steel)	6.76	kg
Recycling 95 %	6.42	kg
Landfilling 5 %	0.34	kg
Collected separately (concrete)	162,11	kg
Recycling 95 %	154	kg
Landfilling 5 %	8,11	kg

Re-Use, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Net flow of steel scrap	3,06	kg/kg

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 linear metre (lm) concrete turnout sleeper with an average weight of 169 kg/lm (conversion factor to 1 kg: 0,006) and a volume of 0,065 m³.

Disclaimer:
EP-freshwater: This indicator has been calculated as “kg P eq” as required in the characterization model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	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	ND	ND	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 lm concrete turnout sleeper (169 kg/lm)

Core Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Global warming potential - total	[kg CO_2-Eq.]	4.20E+1	0.00E+0	5.09E-1	1.37E-1	1.30E-1	-6.87E+0
Global warming potential - fossil fuels	[kg CO_2-Eq.]	4.18E+1	0.00E+0	5.06E-1	1.36E-1	1.40E-1	-6.86E+0
Global warming potential - biogenic	[kg CO_2-Eq.]	1.22E-1	0.00E+0	-8.45E-4	4.54E-4	-1.02E-2	-6.49E-3
GWP from land use and land use change	[kg CO_2-Eq.]	1.99E-2	0.00E+0	4.07E-3	1.97E-4	3.70E-4	-4.34E-3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	4.38E-9	0.00E+0	9.23E-17	2.99E-15	4.93E-16	-3.59E-14
Acidification potential, accumulated exceedance	[mol H^+-Eq.]	9.48E-2	0.00E+0	1.71E-3	3.00E-4	9.36E-4	-1.35E-2
Eutrophication, fraction of nutrients reaching freshwater end compartment	[kg P-Eq.]	1.23E-4	0.00E+0	1.53E-6	3.63E-7	2.24E-7	-5.62E-6
Eutrophication, fraction of nutrients reaching marine end compartment	[kg N-Eq.]	2.79E-2	0.00E+0	7.71E-4	6.67E-5	2.40E-4	-2.61E-3
Eutrophication, accumulated exceedance	[mol N-Eq.]	3.02E-1	0.00E+0	8.62E-3	7.01E-4	2.64E-3	-2.73E-2
Formation potential of tropospheric ozone photochemical oxidants	[kg NMVOC-Eq.]	8.57E-2	0.00E+0	1.52E-3	1.83E-4	7.29E-4	-1.03E-2
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.18E-5	0.00E+0	4.07E-8	3.94E-8	1.22E-8	-1.17E-5
Abiotic depletion potential for fossil resources	[MJ]	3.21E+2	0.00E+0	6.71E+0	2.39E+0	1.85E+0	-7.28E+1
Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	[m³ world-Eq deprived]	2.06E+0	0.00E+0	4.91E-3	2.97E-2	1.27E-2	-1.63E+0

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 lm concrete turnout sleeper (169 kg/lm)

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Renewable primary energy as energy carrier	[MJ]	4.34E+1	0.00E+0	3.88E-1	1.06E+0	2.28E-1	-5.78E+0
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of renewable primary energy resources	[MJ]	4.34E+1	0.00E+0	3.88E-1	1.06E+0	2.28E-1	-5.78E+0
Non-renewable primary energy as energy carrier	[MJ]	3.18E+2	0.00E+0	6.74E+0	2.39E+0	1.85E+0	-7.29E+1
Non-renewable primary energy as material utilization	[MJ]	3.40E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	3.22E+2	0.00E+0	6.74E+0	2.39E+0	1.85E+0	-7.29E+1
Use of secondary material	[kg]	3.36E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.54E+2
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m³]	6.16E-2	0.00E+0	4.52E-4	1.23E-3	4.10E-4	-4.21E-2

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 lm concrete turnout sleeper (169 kg/lm)

Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed	[kg]	9.69E-7	0.00E+0	3.12E-7	9.90E-10	2.57E-8	-2.49E-7
Non-hazardous waste disposed	[kg]	3.16E-1	0.00E+0	1.07E-3	1.70E-3	8.46E+0	5.26E-1
Radioactive waste disposed	[kg]	1.11E-2	0.00E+0	1.24E-5	3.63E-4	2.12E-5	-3.30E-3
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0	1.57E+2	0.00E+0	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 lm concrete turnout sleeper (169 kg/lm)

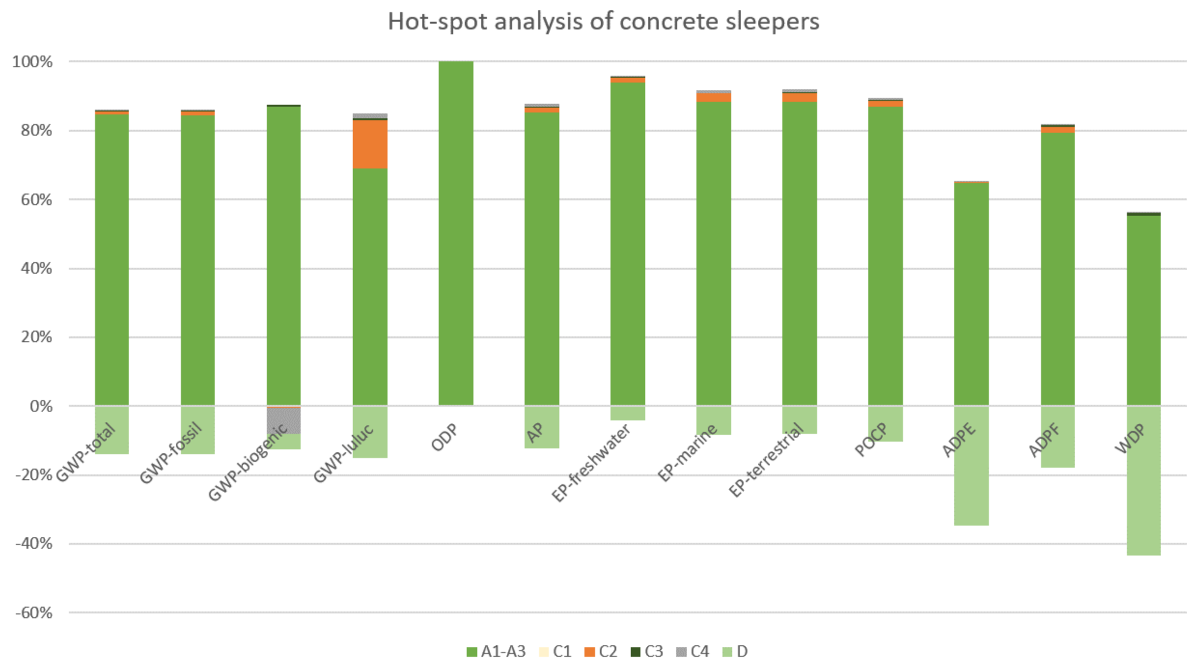
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
Potential incidence of disease due to PM emissions	[Disease Incidence]	3.86E-7	0.00E+0	4.35E-9	6.49E-10	1.52E-8	-1.48E-9
Potential Human exposure efficiency relative to U235	[kBq U235-Eq.]	2.18E-9	0.00E+0	3.51E-11	1.14E-11	1.57E-11	-7.43E-10
Potential comparative toxic unit for ecosystems	[CTUe]	1.24E-6	0.00E+0	9.66E-9	2.52E-9	1.15E-8	-2.64E-7
Potential comparative toxic unit for humans - cancerogenic	[CTUh]	1.71E+0	0.00E+0	1.83E-3	5.96E-2	2.29E-3	-4.05E-1
Potential comparative toxic unit for humans - not cancerogenic	[CTUh]	1.50E+2	0.00E+0	5.02E+0	1.02E+0	9.93E-1	-1.32E+1
Potential soil quality index	[-]	5.72E-9	0.00E+0	1.04E-10	2.83E-11	1.45E-10	1.38E-9

Disclaimer 1 – for the indicator potential human exposure efficiency relative to U235:
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 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 – for the indicators abiotic depletion potential for non-fossil resources, abiotic depletion potential for fossil resources, water (user) deprivation potential, deprivation -weighted water consumption, eutrophication - fraction of nutrients reaching freshwater end compartment, potential comparative toxic unit for humans - cancerogenic, potential comparative toxic unit for humans - not cancerogenic, potential soil quality index:
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.

6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a declared unit of 1 linear metre (lm) of concrete turnout sleeper with an average weight of 169 kg/lm and a volume of 0,065 m³.



The comparison of the products' life cycle phases shows a clear dominance of the production phase (modules A1-A3). Environmental potentials in module D refer to the recycling potential of primary steel as well as gravel.

When it comes to the environmental impacts in the production phase of the sleepers, the production of the concrete components, as well as the prestressing wire, represents major hot-spots in all of the impact categories considered except for potential ozone depletion.

The production of the components used for the concrete can be identified as the main contributor to global warming potential (GWP), eutrophication potential of marine and terrestrial ecosystems (EP-marine & EP-terrestrial), acidification potential (AP), formation potential of tropospheric ozone (POCP), abiotic depletion potential of fossil resources (ADPf) as well as potential water scarcity (WDP). In this context, cement represents the main driving factor. In addition, the production of the prestressing wire also shows a substantial contribution to these impact categories.

When it comes to potential eutrophication of freshwater (EP-freshwater), resource depletion of minerals (ADPE) and biogenic greenhouse gas emissions (GWP-biogenic), the prestressing wire is accountable for the main impact.
The depletion potential of the stratospheric ozone layer (ODP) is dominated by the *ISOPA* dataset applied for the approximation of the flow agent.

The conversion of the LCA results to other sleeper thicknesses than the declared reference thickness correlates to the product weight. This implies a slight imprecision for parts such as dowels and plugs, which do not directly correlate to the product mass. Beyond that, the precise share of concrete and prestressing wire might as well change for different variations. Being aware of these limitations, a conversion based on the product's weight is considered possible.

7. Requisite evidence

7.1 Radioactivity
Not relevant.

7.2 Leaching
Concrete turnout sleepers consist of firmly bound ingredients. Due to the high binding capacity of cement, the risk of leaching is very low.

7.3 VOC-emissions
Not relevant.

8. References

Standards

EN 15804
DIN EN 15804:2020-03. Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products.

ISO 9001
DIN EN ISO 9001:2015-11, Quality management systems - Requirements.

ISO 14001
DIN EN ISO 14001:2015, Environmental management systems - Requirements with guidance for use.

ISO 14025
DIN EN ISO 14025:2011-10, Environmental labels and declarations - Type III environmental declarations - Principles and procedures.

ISO 14044
DIN EN ISO 14044:2006, Environmental management – Life cycle assessment – Requirements and guidelines.

ISO 45001
ISO 45001:2018, Occupational health and safety management systems - Requirements with guidance for use.

ÖNORM B 4710-1
ÖNORM B 4710-1:2018, Concrete - Specification, performance, production, use and conformity.

Further references

European Waste Catalogue
European Waste Catalogue (EWC) Ordinance.

ECHA Candidate List
Candidate List of Substances of Very High Concern (ECHA Candidate List) of 02.12.2020, published in accordance with Article 59 (10) of the REACH Regulation Helsinki: European Chemicals Agency.

GaBi
GaBi 10, Software-System and Database for Life Cycle Engineering. DB v8.7 2020.2. Sphera, 1992-2020. Available at: http://documentation.gabi-software.com.

IBU 2016
Institut Bauen und Umwelt e.V.: General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V., Version 1.1 Institut Bauen und Umwelt e.V., Berlin. www.ibu-epd.com

ISOPA
European Diisocyanate & Polyol Producers Association.

Ordinance on Biocide Products
Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

PCR Part A
Institut Bauen und Umwelt e.V. (IBU), 2019. Product Category Rules for Building-Related Products and Services. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019. Version 1.1. Berlin, 08.01.2021.

PCR: Pre-cast concrete components
Product category rules for building-related products and services. Part B: Requirements of the EPD for Pre-cast concrete components. Version 1.7. Berlin: Institut Bauen und Umwelt e.V., 08.01.2019.

Institut Bauen und Umwelt e.V.	**Publisher** Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	Tel Fax Mail Web	+49 (0)30 3087748- 0 +49 (0)30 3087748- 29 info@ibu-epd.com **www.ibu-epd.com**
Institut Bauen und Umwelt e.V.	**Programme holder** Institut Bauen und Umwelt e.V. Panoramastr 1 10178 Berlin Germany	Tel Fax Mail Web	+49 (0)30 - 3087748- 0 +49 (0)30 – 3087748 - 29 info@ibu-epd.com **www.ibu-epd.com**
Daxner&Merl sustainability strategy responsibility	**Author of the Life Cycle Assessment** Daxner & Merl GmbH Lindengasse 39/8 1070 Wien Austria	Tel Fax Mail Web	+43 676 849477826 +43 42652904 office@daxner-merl.com **www.daxner-merl.com**
voestalpine ONE STEP AHEAD.	**Owner of the Declaration** voestalpine AG voestalpine-Straße 3 4020 Linz Austria	Tel Fax Mail Web	+43/50304/15-0 +43/50304/55-0 info@voestalpine.com **www.voestalpine.com**