Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A2:2019 for:

Galvanized steel components for safety barriers

from

NRS Nordic Road Safety AB

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-07329
Publication date:	2022-11-16
Valid until:	2027-11-16

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 Construction products (EN 15804:A2) (1.2.4)*
PCR review was conducted by: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.
Life Cycle Assessment (LCA)
LCA accountability: Ida Adolfsson and Xenofon Lemperos at Tyréns Sverige AB
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Pär Lindman Miljögiraff AB Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☒ Yes ☐ No

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

EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: NRS Nordic Road Safety AB

Contact: Åke Larsson email: ake.larsson@nordicroadsafety.com

Description of the organisation:
Nordic Road Safety (NRS) is a company that specializes in developing and selling permanent road safety solutions in Sweden. NRS manufactures and sells traffic barriers, bridge railings, centre road barriers and noise barriers and can also help with assembly, design, project management and development.

Product-related or management system-related certifications:
EN 1317–2: It covers requirements for safety barriers, how they shall be tested and how their properties are to be described.
CE-marked products are delivered with CE-certificate, declaration of performance and installation manual. The declaration of performance is written in Swedish which is required by the Swedish Transport Administration and the National Board of Housing, Building and Planning (BFS 2013:7SEK).
BASTA (Sweden): The core of BASTA is EU Regulation EC 1907/2006 (REACH) and its requirements regarding chemical content. BASTA calls upon those wishing to choose materials in a conscious way aiming to phase out dangerous substances.

Name and location of production site(s):
NRS Nordic Road Safety AB
Headquarters and production site
Årvältsvägen 18
861 36 Timrå, Sweden

Product information

Product name:
Galvanized steel components for safety barriers

Product description:
Road safety barrier's purpose is to increase traffic safety by preventing vehicles from driving off the road, into dangerous objects or into objects that need protection from colliding vehicles. Based on road classification, there are specific rules and guidelines for choosing a combination of guardrail and pole so that the road safety barrier can function optimally depending on the situation.

A safety barrier system consists of two parts. A horizontal guardrail and a vertical post that is assembled on site with screws and built into the ground at the roadside. Both parts are galvanized steel sheet profiles that have different shapes and steel qualities depending on use and road safety requirements.

In this EPD the product under assessment is the safety barrier that includes rounded, rectangular, beam, and flat steel profiles with steel strength classification S235, S355 and S420. Materials used for this product are produced in factories located in Sweden.

Manufacturing process:
The material used for the profiles is hot-rolled steel in thin sheets between 2 and 10 millimetres, which are then cut and bent into a profile. The steel profiles are delivered to NRS factory where they are being cut and welded together to form the final safety barrier product. The final production step is a hot-dip galvanizing process where the products are transported to an external factory and dipped in zinc hot bath to get sufficient protection against rust and weather elements. After galvanizing process, the pieces are transported to back NRS storage facility in Timrå in Sweden. Depending on the project and road safety requirements, NRS designs the road safety barriers and transports the products to the road construction site for assembly.

UN CPC code: 41231

Geographical scope:
Production stage: Sweden
Use stage and End of life stage: Sweden

LCA information

Declared unit: 1 tonne

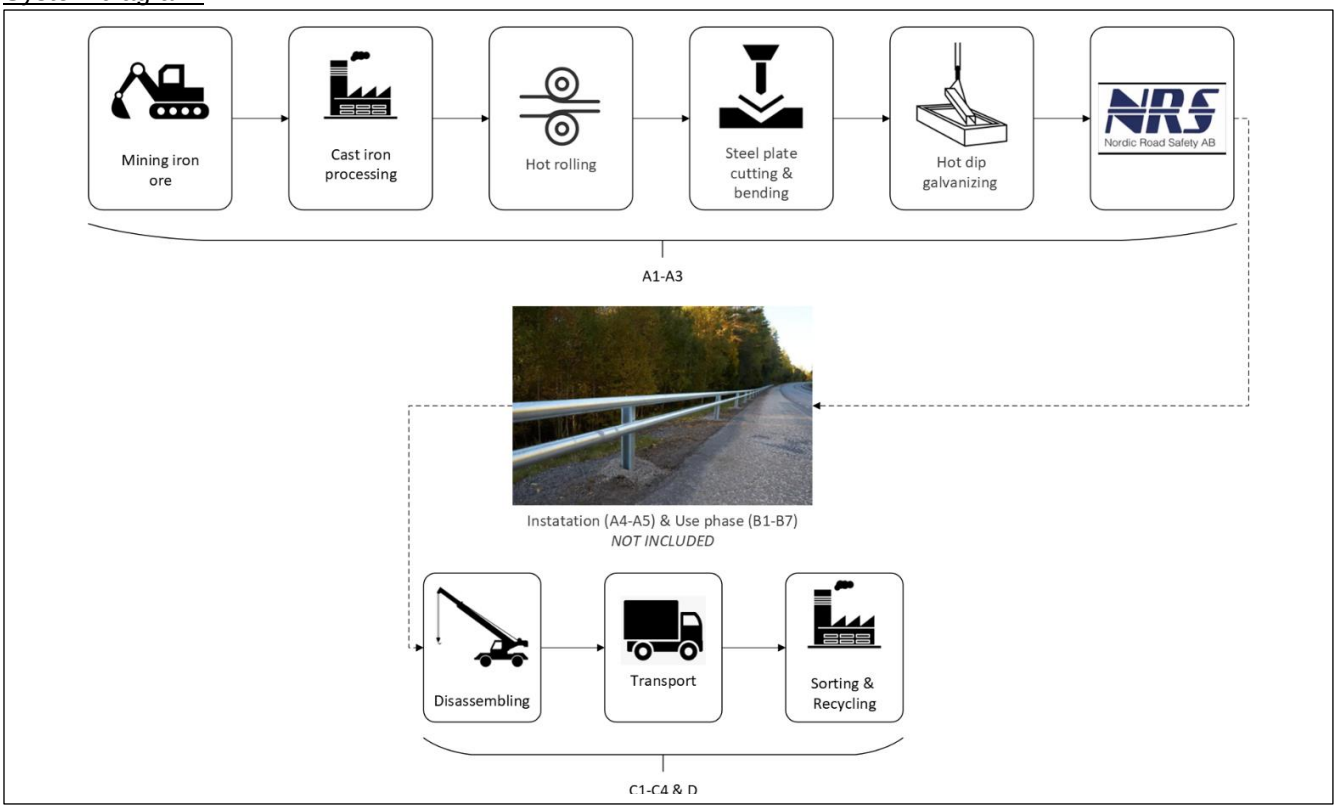
Conversion factor: 5.02 kg/meter

Time representativeness: The data represents the period between 09/2021 and 03/2022.

Database(s) and LCA software used:
The LCA software is SimaPro 9.4.0.2 and the database is EcoInvent 3.8. When modelling in Simapro, Ecoinvent data (updated February 2022) has been used for generic data.

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

System diagram:



Included	Excluded
Production (A1-A3) • Production of raw materials and consumed materials. • Transport of raw materials • Transport of steel products to NRS • Laser cutting and welding in the NRS factory. • Energy and fuel use in the NRS factory. • Transport back and forth to the hot-dip galvanizing facility in Skellefteå, Sweden. • Hot-dip galvanizing process of steel products. • Production of packaging material for goods delivered to NRS. • Production of packaging material for goods sent from NRS. • Transport of recyclable residual material from NRS to reception facilities.	Production (A1-A3) • Final galvanized safety barrier parts that are purchased from suppliers outside Sweden (modelled in EPDs S-P06849 & S-P0685) • NRS factory building infrastructure
	Installation (A4-A5)
	Use phase (B1-B7)
End of life (C1-C4) • Disassembly of guardrail and transportation to waste management facilities. • The product does not require any treatment before it is recycled and therefore C3 module equals to zero.	
Benefits and loads beyond the system boundary (D) • Steel recycling	

More information:
LCA practitioners:
Ida Adolfsson – Environmental specialist Tyréns Sverige AB
Ida.Adolfsson@tyrens.se

Xenofon Lemperos – Environmental consultant Tyréns Sverige AB
Xenofon.Lemperos@tyrens.se

Allocations:
Mass allocation method was used for energy consumption and waste disposal at NRS facility to determine the environmental impact for 1 tonne of safety barrier.

Main assumptions:

- Steel material for safety barrier has different steel strength classifications that depend on road safety requirements. It is assumed that different steel strength classifications have the same environmental impact.
- Steel density 7850kg/m^3
- Wood density 470kg/m^3
- Diesel density 0.845kg/l
- Diesel heat value 0.0234kg/MJ
- Transport distance to recycling site for disassembled safety barrier assumed to be 500km
- An empty gas cylinder weighs22kg
- A pallet collar weighs 9kg
- A Europallet weighs 25kg
- Electricity supplier of NRS has origin labelled renewable electricity. The distribution of renewable sources equals with the distribution of renewable sources in the Ecoinvent data for the Swedish electricity production mix.

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

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	SE	SE	SE	ND	ND	ND	ND	ND	ND	ND	ND	ND	SE	SE	SE	SE	SE
Specific data used	50%[1]					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	Not relevant					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant					-	-	-	-	-	-	-	-	-	-	-	-

[1] The percentage of specific data is assumed to be larger than 50%, but it cannot be proved since EPDs that are used as data sources lack information on the percentage of specific data used.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Steel	924	20%	0%
Zink	76	0%	0%
TOTAL	1000	18.5%	0%
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	
Plastic straps	0.040	<0.1%	
Wood	2.04	<0.1%	
TOTAL	2.08	<0.1%	

The product does not include any dangerous substances from the candidate list of SVHC.

Environmental Information

Potential environmental impact – mandatory indicators according to EN 15804

Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot.A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-fossil	kg CO_2 eq.	2.63E+03	6.88E+01	5.50E+02	3.25E+03	2.04E+00	8.14E+01	0.00E+00	8.27E-01	-1.18E+03
GWP-biogenic	kg CO_2 eq.	1.91E+01	1.85E-01	-1.38E+01	5.49E+00	1.75E-03	2.19E-01	0.00E+00	2.92E-03	3.91E+00
GWP-luluc	kg CO_2 eq.	1.91E+00	2.75E-02	2.62E+00	4.56E+00	2.01E-04	3.26E-02	0.00E+00	7.82E-04	-7.27E-01
GWP-total	kg CO_2 eq.	2.65E+03	6.90E+01	5.39E+02	3.26E+03	2.04E+00	8.17E+01	0.00E+00	8.31E-01	-1.18E+03
ODP	kg CFC 11 eq.	7.58E-06	1.59E-05	7.89E-05	1.02E-04	4.31E-07	1.89E-05	0.00E+00	3.35E-07	-5.13E-05
AP	mol H^+ eq.	1.05E+01	1.95E-01	4.16E+00	1.49E+01	1.13E-02	2.31E-01	0.00E+00	7.78E-03	-4.39E+00
EP-freshwater	kg PO_4^{3-} eq.	3.40E+00	1.37E-02	9.80E-01	4.40E+00	1.90E-04	1.62E-02	0.00E+00	2.30E-04	-1.58E+00
EP-freshwater	kg P eq.	1.12E+00	4.51E-03	3.24E-01	1.45E+00	6.25E-05	5.34E-03	0.00E+00	7.58E-05	-5.21E-01
EP-marine	kg N eq.	2.51E+00	3.97E-02	9.74E-01	3.52E+00	4.56E-03	4.70E-02	0.00E+00	2.71E-03	-1.05E+00
EP-terrestrial	mol N eq.	2.39E+01	4.33E-01	1.11E+01	3.54E+01	5.01E-02	5.12E-01	0.00E+00	2.96E-02	-1.10E+01
POCP	kg NMVOC eq.	1.07E+01	1.66E-01	2.82E+00	1.37E+01	1.42E-02	1.97E-01	0.00E+00	8.62E-03	-5.54E+00
ADP-minerals&metals*	kg Sb eq.	1.47E-02	2.44E-04	1.21E-01	1.36E-01	1.04E-06	2.89E-04	0.00E+00	1.89E-06	3.07E-04
ADP-fossil*	MJ	2.64E+04	1.04E+03	8.07E+03	3.56E+04	2.77E+01	1.23E+03	0.00E+00	2.31E+01	-1.14E+04
WDP	m^3	5.58E+02	3.07E+00	2.84E+02	8.46E+02	3.95E-02	3.64E+00	0.00E+00	1.04E+00	-2.47E+02
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential. Accumulated Exceedance; EP-freshwater = Eutrophication potential. fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential. fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential. Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential. deprivation-weighted water consumption									

** Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.*

Potential environmental impact – additional mandatory and voluntary indicators

Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot. A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[2]	kg CO_2 eq.	2.63E+03	6.83E+01	5.48E+02	3.24E+03	2.02E+00	8.08E+01	0.00E+00	8.13E-01	-1.13E+03

Use of resources

Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot. A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	3.18E+03	1.49E+01	2.36E+03	5.56E+03	1.56E-01	1.76E+01	0.00E+00	1.97E-01	-3.41E+02
PERM	MJ	4.45E+00	0.00E+00	1.72E+02	1.77E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.18E+03	1.49E+01	2.54E+03	5.74E+03	1.56E-01	1.76E+01	0.00E+00	1.97E-01	-3.41E+02
PENRE	MJ	2.55E+04	1.11E+03	8.60E+03	3.52E+04	2.94E+01	1.31E+03	0.00E+00	2.46E+01	-1.20E+04
PENRM	MJ.	8.67E-02	0.00E+00	8.64E-01	9.51E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.55E+04	1.11E+03	8.60E+03	3.52E+04	2.94E+01	1.31E+03	0.00E+00	2.46E+01	-1.20E+04
SM	kg	2.00E+02	0.00E+00	0.00E+00	2.00E+02	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	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	0.00E+00
FW	m^3	1.94E+01	5.15E-02	4.52E+00	2.39E+01	4.86E-04	6.10E-02	0.00E+00	8.82E-04	-2.14E+00
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

[2] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Waste production and output flows

Waste production

Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot. A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4.78E+01	0.00E+00	0.00E+00	4.78E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	4.64E+01	0.00E+00	0.00E+00	4.64E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	3.76E+01	0.00E+00	0.00E+00	3.76E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output flows

Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot. A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	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
Material for recycling	kg	3.75E+01	0.00E+00	7.58E+01	1.13E+02	0.00E+00	0.00E+00	8.55E+02	0.00E+00	0.00E+00
Materials for energy recovery	kg	2.95E+00	0.00E+00	1.33E+01	1.63E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy. electricity	MJ	2.84E+00	0.00E+00	0.00E+00	2.84E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy. thermal	MJ	5.35E+00	0.00E+00	0.00E+00	5.35E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Information on biogenic carbon content

Results per declared unit		
BIOGENIC CARBON CONTENT	**Unit**	**QUANTITY**
Biogenic carbon content in product	kg C	0
Biogenic carbon content in packaging	kg C	4.4

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

Additional information

NRS has developed two more EPD for safety barrier products.
These are: S-P-06849 Guardrail for traffic barriers and S-P-06851 Pole for traffic barriers

Additional environmental impact indicators from EN 15804

Results per declared unit										
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot.A1-A3**	**C1**	**C2**	**C3**	**C4**	**D**
Particulate matter	diseas e inc.	1.84E-04	4.35E-06	4.25E-05	2.30E-04	1.90E-07	5.16E-06	0.00E+00	1.52E-07	-8.34E-05
Ionising radiation	kBq U-235 eq	1.35E+02	5.37E+00	8.97E+01	2.30E+02	1.25E-01	6.36E+00	0.00E+00	1.03E-01	-2.69E+01
Ecotoxicity. freshwater	CTUe	7.36E+04	8.18E+02	5.26E+04	1.27E+05	1.62E+01	9.69E+02	0.00E+00	1.46E+01	-3.27E+04
Human toxicity. cancer	CTUh	1.86E-05	2.63E-08	2.07E-06	2.07E-05	2.30E-09	3.12E-08	0.00E+00	3.70E-10	-7.02E-06
Human toxicity. non-cancer	CTUh	7.74E-05	8.27E-07	4.53E-05	1.24E-04	1.33E-08	9.79E-07	0.00E+00	9.60E-09	-2.37E-05
Land use	Pt	8.42E+03	7.27E+02	6.92E+03	1.61E+04	3.52E+00	8.60E+02	0.00E+00	4.85E+01	-2.74E+03

References

Ecoinvent. (2022). EcoInvent 3.8, tillgänglig databas i SimaPro version 9.4.0.2 Multi User. https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-8/.

EN 15804:2012+A2:2019: Sustainability of construction works- Environmental Product Declarations - Core rules for the product category of construction products. (n.d.). *European Standard*.

General Programme Instructions (GPI) of the International EPD® System - Verison 4.0. (2021). *EPD International*.

Lemperos, X., & Adolfsson, I. (2022). *Nordic Road Safety (NRS) Vägräcke delar LCA rapport.* Stockholm: Tyréns AB.

Lemperos, X., & Adolfsson, I. (2022). *Nordic Road Safety (NRS) Vägräcke LCA rapport.* Tyréns AB.

Product Category Rules (PCR) 2019:14 Construction products Version 1.2.4. (2022). *EPD International*.

Stena Stål AB. (2021). S-P-02626: Steel beams. *EPD International AB*.

Stena Stål AB. (2021). S-P-02628: Merchant bars. *EPD International AB*.

Stena Stål AB. (2021). S-P-04604: Structural hollow section. *EPD International AB*.

Tibnor AB. (2020). S-P-02042: Hot rolled Strip. *EPD International AB*.

Tibnor AB. (2020). S-P-02044: Cold-formed Structural hollow sections. *EPD International AB*.

Tibnor AB. (2020). S-P-02046: Merchant bars. *EPD International AB*.

World Steel Association. (2022, 10). Retrieved from https://worldsteel.org/publications/fact-sheets/

EPD®

www.environdec.com