Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Wing Foundation

TerraWing T92 VK5010 L25 P2227t25

from

TerraWing AB

Programme:	The International EPD® System, www.environdec.com
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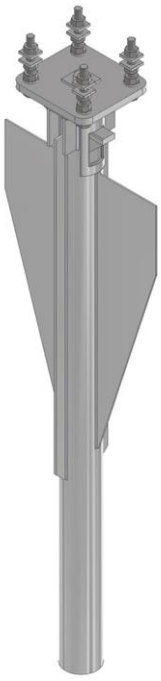

General information

Programme information

Programme:	The International EPD® System
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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 version 1.3.4 Construction products
PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review chair: 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: Karin Eriksson, Envima 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: *Viktor Hakkarainen, CHM Analytics 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 registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD:
TerraWing AB
Gasverksvägen 15, 611 35 Nyköping, Sweden
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Org.nr: 556623-1394

Contact: Magnus Odart

Description of the organisation: TerraWing AB is a Swedish company with extensive expertise in wing foundations, construction projects, and noise barriers. Since 2003, TerraWing AB has been developing and delivering wing foundations for the installation of noise barriers.

Name and location of production site(s): SIA "MW konstrukcijas", Pulkveža Brieža 113, LV-2150 SIGULDA, Latvia and SIA "Tetralia", Riga, Stabu iela 49 -3, Latvta, LV-1 01 1

Product information

Product name: TerraWing T92 VK5010 L25 P2227t25

Product description: TerraWing AB's Wing Foundations, including TerraWing T92 VK5010 L25 P2227t25, are primarily designed as the base for noise barrier screens. These foundations are made from steel and offer several key advantages. With a high capacity of 4 to 15 foundations installed per hour, they eliminate the need for excavation, drilling, backfilling, compaction, formwork, casting, or welding. Additionally, the foundations can be installed even when the ground is frozen and are suitable for most soil conditions. Minimal preparation and post-installation work are required, making the product cost-effective and easy to use.

For more information visit terrawing.se

UN CPC code: 421 Structural metal products and parts thereof

Geographical scope: Sweden

LCA information

Functional unit / declared unit: 1 kg of wing foundation

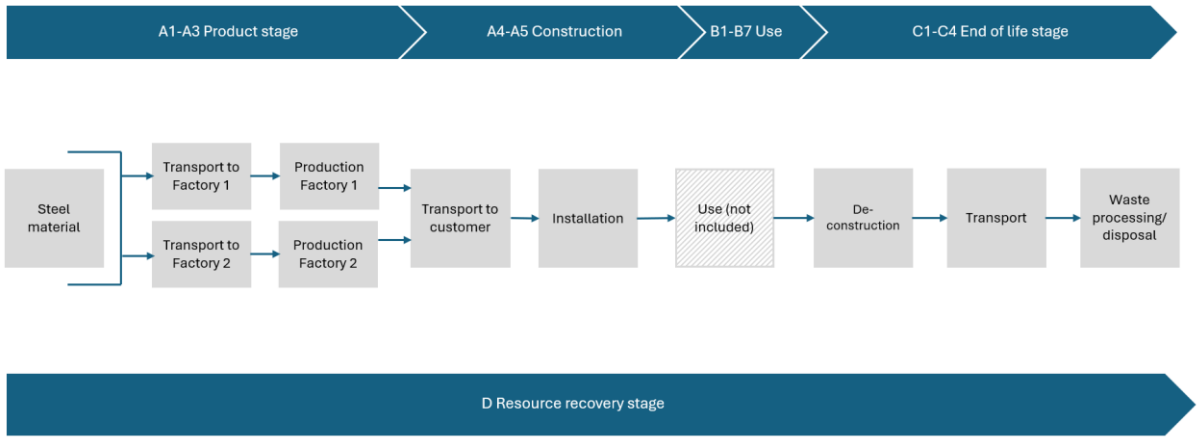
Time representativeness: 2023

Database(s) and LCA software used: SimaPro 9.5, Ecoinvent 3.9.1

Description of system boundaries: Cradle to gate with options, modules A4, A5 C1–C4, module D. (A1-A3+A4+A5+C1-C4+D)

Electricity used in A3: Latvian residual mix (2022), GWP-GHG: 0.685 kg CO2-eq/kWh.

System diagram:



The manufacturing steps at the two facilities (A3) can be described as follows:

Factory 1 Production Process:

1. **Steel Tubes, Bars, and Profiles**: These materials are cut to the required length upon arrival, prepared, and then welded together.
2. **Steel Plates for Wings**: Plates are cut to shape using shears, then prepared and welded.
3. **TWP and TWF Plates**: These plates are thermally cut using laser or plasma cutting methods, drilled for holes, and prepared for either pole welding or hot-dip galvanizing (HDG).
4. **Hot-Dip Galvanizing (HDG)**: All products undergo hot-dip galvanizing to ensure protection against corrosion and durability.

Factory 2 Production Process:

1. **Material Receipt and Inspection**: Materials are unloaded from trucks and subjected to a thorough quality inspection. Any potential issues that could impact later stages are documented, and stock levels are updated based on material documentation.
2. **Sorting and Processing Streams**: After inspection, materials are sorted into different processing streams for further handling.
3. **Plates**: Plates are sent to a subsidiary for **CNC plasma cutting**. Once cut, the parts are cleaned, inspected, and machined if needed. If plates require marking, they are labeled before proceeding to the next stage.
4. **Tubes**: Tubes are cut to the required length using a bandsaw, and holes are created using a CNC plasma cutter. Afterward, the tubes are cleaned.
5. **Beams**: Beams are also cut to size with a bandsaw and cleaned in preparation for welding.
6. **Assembly**: Once all parts have been processed, they are brought together for assembly. The foundations are first assembled and welded. Following this, the welds are cleaned and deburred.
7. **Galvanization**: After assembly, all parts go through the galvanization process for added protection and durability.
8. **Packing and Shipment**: Finally, the complete components are packed and prepared for shipment to the site.

Transport (A4)
The transport from the production facilities in Latvia is estimated to be around 65 km by lorry from the production facility to the port in Riga. From there, the goods are transported by ferry for about 500 km to a port in Stockholm. Finally, the goods are delivered by lorry, with an average distance of around 250 km from the port to the customer.

Installation (A5)
When installing the foundations an excavator or specialized machine with an attached hydraulic hammer is used. The machines consume approximately 0,8 liters of diesel per foundation. As mentioned TerraWing primarily sells their products to Sweden and Norway. The energy content of diesel was assumed to 35,3 MJ/liter in Sweden. There is no waste that needs to be removed from the site after installation, which is one of the benefits of TerraWing's products.

End of life stages (C1-C4)
The end-of-life stages for TerraWings products include deconstruction (C1), transport to waste facility (C2), recycling of steel (C3), and disposal/landfill (C4).

The deconstruction process is assumed to be performed in the same manner as the installation, requiring the same amount of fuel. The average transport distance to waste facility is assumed to be 50 km. PCR 2019:14 states that the EU R2 recycling values should be used as default, for steel the recycling rate in Europe is 85 %. For many countries the recycling rate for steel is significantly higher. The remaining amount of steel (15 %) is assumed to go to landfill.

Benefits and loads beyond the system boundaries (D)
Module D claims the benefits and loads of the amount recycled material in the steel. The share of recycled material going into the system is different for each product and is based on the total amount of recycled material in the raw material (pre-and post-consumer steel). For TerraWing T92 VK5010 L25 P2227t25 the amount of recycled material is around 38 %.

Cut-off criteria
The cut-off criteria are 95 % of total inflows (mass and energy) and environmental impact per module (A1-A3, A4, A5, C1-C4 and D) as specified in Chapter 4.4 in the PCR.

Data quality
All data has been gathered from specific sources whenever possible. For the core process, specific data from the production have been used. Where specific data could not be collected for certain inflows, generic data has been used instead, sourced from the SimaPro 9.5 software and Ecoinvent 3.9.1 database.

Allocation and key assumptions
Allocation follows the requirements outlined in EN 15804. This Environmental Product Declaration (EPD) represents a TerraWing foundation, based on data collected from two production sites, with calculations reflecting an average impact value. Therefore, some products may have a lower or higher actual environmental impact than what is declared.

Certain assumptions have been made for underlying data. EPDs based on the EN 15804:2012+A1 standard were used for some raw materials purchased by TerraWing’s suppliers. These are assumed to be applicable, contributing to a higher proportion of specific data. Missing impact categories in these EPDs have been supplemented with generic data.

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

	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	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	GLO, LV			EUR	SE/NO	-	-	-	-	-	-	-	SE/ NO	SE/ NO	SE/ NO	SE/ NO	SE/NO
Specific data used	68%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	14%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Content information

Product components	**Weight, kg**	**Post-consumer material, weight-%**	**Biogenic material, weight-% and kg C/kg**
Galvanized steel	1	32%	-
TOTAL	1	32%	-
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
Polyethylene	4.13E-6	4.13E-4	-
Wood	2.47E-04	2.47E-2	1.22E-5
EU pallet	5.06E-03	5.1E-1	2.98E-3
TOTAL	5.31E-3	5.31E-1	3.10E-3

The product contains no substances included in the REACH Candidate list (Substance of Very High Concern).

Results of the environmental performance indicators

The following tables show the results of the life cycle assessment for 1 kg TerraWing T92 VK5010 L25 P2227t25.

Infrastructure is not included in the calculations, except in the case of energy flows, where it is included. The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks. The use of results from modules A1–A3 without considering the outcomes of module C is discouraged, as it may lead to an incomplete assessment.

Mandatory impact category indicators according to EN 15804 +A2 Method V1.01 / EF 3.1 normalization and weighting set

Results per functional or declared unit

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-fossil	kg CO_2 eq.	1.97E+00	1.04E-01	2.72E-02	2.08E-02	7.64E-03	1.98E-02	4.05E-04	-6.49E-01
GWP-biogenic	kg CO_2 eq.	-2.04E-02	2.31E-05	2.01E-02	3.88E-06	2.31E-06	3.11E-04	1.59E-07	-1.09E-03
GWP-luluc	kg CO_2 eq.	9.89E-04	2.81E-06	9.72E-07	8.52E-07	1.50E-07	1.53E-05	2.03E-08	-2.24E-04
GWP-total	kg CO_2 eq.	1.99E+00	1.04E-01	3.81E-02	2.09E-02	7.64E-03	2.01E-02	4.05E-04	-6.50E-01
AP	mol H^+ eq.	6.97E-03	1.89E-03	2.03E-04	2.00E-04	1.99E-05	1.32E-04	3.77E-06	-2.88E-03
EP-freshwater	kg P eq.	4.57E-04	7.79E-08	2.15E-08	1.78E-08	6.00E-09	3.11E-07	1.43E-09	-4.53E-05
EP-marine	kg N eq.	1.86E-03	4.96E-04	9.55E-05	9.38E-05	7.78E-06	5.62E-05	1.71E-06	-6.27E-04
EP-terrestrial	mol N eq.	2.00E-02	5.46E-03	1.04E-03	1.02E-03	8.24E-05	6.09E-04	1.86E-05	-6.63E-03
POCP	kg NMVOC eq.	8.31E-03	1.51E-03	3.05E-04	3.00E-04	3.21E-05	1.84E-04	5.57E-06	-3.40E-03
ODP	kg CFC 11 eq.	9.29E-08	1.88E-09	3.69E-10	3.29E-10	1.65E-10	3.53E-10	6.02E-12	-1.25E-08
ADP-minerals&metals*	kg Sb eq.	7.79E-06	2.25E-09	9.11E-10	8.76E-10	2.62E-10	8.81E-10	1.61E-11	-5.03E-06
ADP-fossil*	MJ	2.35E+01	1.33E+00	2.76E-01	2.74E-01	1.02E-01	2.90E-01	5.21E-03	-5.81E+00
WDP*	m^3	4.98E-01	1.19E-03	4.31E-04	3.52E-04	9.29E-05	9.71E-04	7.18E-06	2.07E-01
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 the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity, noncancer and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets, in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.*

Resource use indicators

The result of the energy demand is calculated using: Cumulative Energy Demand V1.12 / Cumulative energy demand. Option B have been used, according to Annex 3 in PCR 2019:14 (ver. 1.3.4).

Results per functional or declared unit

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	1.20E+00	2.83E-03	1.61E-01	5.34E-04	2.67E-04	1.38E-02	2.32E-05	-2.94E-01
PERM	MJ	3.46E-01	0.00E+00	-1.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	1.55E+00	2.83E-03	6.42E-04	5.34E-04	2.67E-04	1.38E-02	2.32E-05	-2.94E-01
PENRE	MJ	2.23E+01	1.41E+00	2.93E-01	2.92E-01	1.08E-01	3.08E-01	5.53E-03	-6.16E+00
PENRM	MJ	3.99E-01	0.00E+00	0.00E+00	0.00E+00	-1.25E-04	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ	2.27E+01	1.41E+00	2.93E-01	2.92E-01	1.08E-01	3.08E-01	5.53E-03	-6.16E+00
SM	kg	4.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	1.98E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	3.46E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	4.06E-01	4.71E-05	1.64E-05	1.47E-05	2.23E-06	1.04E-04	3.24E-07	-3.53E-03
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								

GWP - GHG indicators

The method used to calculate these is the IPCC 2021 GWP 100 (incl. CO2 uptake) V1.02. Biogenic carbon dioxide is excluded from the results in these tables even if they are included in the calculation method. Emissions related to fossil, land use and land use change are the only ones included in these results.

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
GWP - GHG	kg CO_2 eq.	2.03E+00	1.04E-01	2.72E-02	2.08E-02	7.64E-03	1.98E-02	4.05E-04	-6.49E-01

Waste indicators

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	7.92E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	9.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Radioactive waste disposed	kg	2.11E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Output flow indicators

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**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
Material for recycling	kg	4.20E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.85E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	3.14E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy. electricity	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
Exported energy. thermal	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

GWP-GHG results for modules A1-A3 variation between sites

The variation in percentage between the production sites is primarily due to differences in where the components to the foundation are sourced.

Indicator	Unit	A1-A3
GHG-GWP	%	14

References

General programme instructions for the international EPD System version 4.0 (2021)

EN 15804:2012 + A2:2019 Sustainability of construction works – Environmental declaration- core rules for the product category construction products.

ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations- Principles and procedures.

PCR 2019:14 (version 1.3.4), Construction products

Life Cycle Assessment report in support of Environmental Product Declarations (EPD) for – Wing foundations (2025)

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