Environmental Product Declaration

Helix Steel

Helix® 5-25 BAZ, Helix® 5-25 Z, and Helix® 5-25 BA

ASTM INTERNATIONAL

According to
EN 15804
ISO 21930
ISO 14025

1. General Information

Manufacturer Name:	Helix Steel – 2300 Washtenaw Avenue, Suite 201, Ann Arbor, MI 48104
Program Operator:	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959, USA
Declaration Number:	EPD 637
Reference PCR:	ISO 21930: 2017
Date of Issuance:	Feb 14, 2024
End of Validity:	Feb 14, 2029
Product Name:	Helix® 5-25 BAZ, Helix® 5-25 Z, and Helix® 5-25 BA
EPD Owner:	Helix Steel
Declared Unit:	1 ton of Helix® 5-25 BAZ, 5-25 Z, 5-25 BA
EPD Scope:	Cradle-to-gate (A1, A2, and A3)
Verification:	ISO 21930 serves as the core PCR. Independent verification of the declaration according to ISO 14025 and ISO 21930. ☐ internal ☒ external
LCA Reviewer and EPD Verifier:	Timothy S. Brooke ASTM International

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2. Product

2.1 Product Description

The declared product is Helix® 5-25 Micro Rebar®. This product is a twisted steel wire that is used for the following applications: structural walls, structural floors, foundations, beams/columns, shotcrete, pacing, precast, and rebar replacement. The wire allows for efficient tensile stress re-distribution within concrete prior to the concrete cracking. This contributes to an increase in the concrete's strain capacity and pre-crack properties. The declared functional unit is 1 ton of Helix® 5-25 Micro Rebar®. The dosage of Helix® 5-25 Micro Rebar® per cubic yard or cubic meter of concrete is determined in accordance with either ICC-ES ER 3949[1] or IAPMO-ES ER 279.[2]

2.2 Technical Data

Table 1 provides technical data for Helix® 5-25 Micro Rebar®.

Table 1: Technical Data

Name	Value	Unit
Length	25	mm
Diameter	0.50	mm
Density	25,307	Fibers/kg
Tensile Strength	246.5	ksi minimum

2.3 Base Materials

The product is made entirely from High Carbon Steel Wire.

Figure 1. Helix® 5-25 Micro Rebar®.

[1] https://icc-es.org/report-listing/esr-3949/

[2] https://www.iapmoes.org/media/24427/er_0279.pdf

3. LCA Calculation Rules

3.1 Declared Unit

The declared unit is 1 ton of Helix® 5-25 BAZ, Helix® 5-25 Z, and Helix® 5-25 BA produced at Helix Steel's Grand Rapids Manufacturing production facility.

3.2 System Boundary

The system boundary for this study is limited to a cradle-to-gate focus. (see also Table 4):

- ***A1 Raw material supply***: Extraction, handling, and processing of input materials.
- ***A2 Transportation:*** Transportation of all input materials from the suppliers to the gate of the manufacturing facility.
- ***A3 Manufacturing*:** The preparation processes of Helix Steel's manufacturing facility. This phase also includes the operations of the manufacturing facility and all process emissions that occur at the production facility.

3.3 Estimates and Assumptions

All significant foreground data was gathered from the manufacturer based on measured values.

3.4 Cut-off Criteria

The cut-off criteria for all activity stage flows considered within the system boundary conform with ISO 21930: 2017 Section 7.1.8. Specifically, the cut-off criteria were applied as follows:

- All inputs and outputs for which data are available are included in the calculated effects and no collected core process data are excluded.
- A one percent cut-off is considered for renewable and non-renewable primary energy consumption and the total mass of inputs within a unit process. The sum of the total neglected flows does not exceed 5% of all energy consumption and mass of inputs.
- All flows known to contribute a significant impact or to uncertainty are included.
- The cut-off rules are not applied to hazardous and toxic material flows – all of which are included in the life cycle inventory.

No material or energy input or output was knowingly excluded from the system boundary.

3.5 Background Data and 3.6 Data Quality

Data was gathered for the primary material and energy inputs used in production for calendar year 2020. Table 3 describe each LCI data source for raw materials (A1), transportation (A2) and the core manufacture process (A3). Table 3 also includes a data quality assessment for on the basis of the technological, temporal, and geographical representativeness.

Table 3: Secondary Data Sources and Data Quality Assessment

A1: Raw Material Inputs

Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
EAF Steel (used in Helix 5-25 BA)	Concrete Reinforcing Steel Institute: EPD for Fabricated Steel Reinforcement	US	2022	**Technology:** good Process models average US technology **Time:** very good Data is <5 years old **Geography:** good Data is representative of US conditions.
Galvanized EAF Steel (used in Helix 5-25 BAZ and Helix 5-25 Z)	Concrete Reinforcing Steel Institute: EPD for Fabricated Steel Reinforcement, adjusted with galvanizing from Steel hot dip galvanised - Worldsteel	US	2022	**Technology:** good Process models average US technology **Time:** very good Data is <5 years old **Geography:** good Data is representative of US conditions.

A2: Transportation

Inputs	LCI Data Source	Geography	Year	Data Quality Assessment
Trucking	USLCI: Transport, combination truck, long-haul, diesel powered/tkm/RNA	Global	2014	**Technology:** very good Process models average global technology **Time:** good Data is <10 years old **Geography:** very good Data is representative of global conditions.
Rail	USLCI: Transport, train, diesel powered/US	Global	2014	**Technology:** very good Process models average global technology **Time:** good Data is <10 years old **Geography:** very good Data is representative of global conditions.
Ocean	USLCI: Transport, ocean freighter, average fuel mix/US	Global	2014	**Technology:** very good Process models average global technology **Time:** good Data is <10 years old **Geography:** very good Data is representative of global conditions.

A3: Manufacturing				
Energy	**LCI Data Source**	**Geography**	**Year**	**Data Quality Assessment**
Electricity	Ecoinvent 3: Electricity, low voltage {RFC}| market for | Cut-off, U	Global	2018	**Technology:** very good **Time:** good Data is <5 years old **Geography:** very good
Propane	USLCI: Liquefied petroleum gas, combusted in industrial boiler/US	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Cardboard Boxes	USLCI: Corrugated board, mixed fibre, single wall, at plant/RER with US electricity	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Shrink Wrap	USLCI: Packaging film, low density polyethylene {GLO}| market for | Alloc Def, U	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Greases	USLCI: Diesel, at refinery/l/US	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.
Non-Hazardous - Regular Landfill	USLCI: Process-specific burden, sanitary landfill {RoW}| processing | Alloc Def, U	Global	2014	**Technology:** very good **Time:** good Data is <10 years old **Geography:** very good.

3.7 Period under Review

Data was gathered for the material and energy inputs used in the production for calendar year 2020. Data for the primary material inputs is representative of 2023 processes.

3.8 Allocation

At Helix Steel several different steel products are produced. Since the primary data for manufacturing was only available on a facility level, the environmental load among the products produced is allocated according to its mass. For waste that is recycled, the 'recycled content approach' was chosen. The recycling of waste generated by the product system is cut off.

3.9 Comparability

This LCA was created using industry average data for upstream materials. Data variation can result from differences in supplier locations, manufacturing processes, manufacturing efficiency and fuel types used.

4. LCA Results

Life cycle impact assessment (LCIA) is the phase in which the set of results of the inventory analysis – the inventory flow table – is further processed and interpreted in terms of environmental impacts and resource use inventory metrics.Table 4 and 5 below summmarizes the LCA results for the cradle-to-gate (A1-A3) product system.

Table 4: Description of the System Boundary (x: included in LCA; mnd: module not declared; mnr: module not reported)

Product			Construction Installation		Use							End-of-life				Benefits Beyond the System Boundary		
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
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
x	x	x	mnd	mnd	mnd	mnd	mnr	mnr	mnr	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd	mnd

Table 5. LCIA Results for 1 ton Helix® 5-25 BAZ and Helix® 5-25 Z Micro Rebar®						
Environmental Indicator	**Abbreviation**	**Units**	**Total**	**A1**	**A2**	**A3**
Core Mandatory Impact Indicator						
Global warming potential	**GWP**	kg CO2-eq	1.37E+03	8.80E+02	2.82E+02	2.10E+02
Depletion potential of the stratospheric	**ODP**	kg CFC-11-	2.72E-06	1.12E-09	1.19E-08	2.71E-06
Acidification potential of land and water	**AP**	kg SO2-eq	6.54E+00	2.24E+00	3.72E+00	5.76E-01
Eutrophication potential	**EP**	kg PO4-eq	4.20E-01	1.21E-01	2.16E-01	8.38E-02
Formation of tropospheric ozone	**SFP**	Kg O3-eq	1.52E+02	5.06E+01	9.58E+01	5.74E+00
Abiotic depletion potential for fossil	**ADPF**	MJ Surplus	1.37E+03	8.80E+02	2.82E+02	2.10E+02
Fossil Fuel Depletion	**FFD**	MJ Surplus	8.33E+02	0.00E+00	5.98E+02	2.35E+02
Use of Primary Resources						
Renewable primary energy carrier used as energy	**RPRE**	MJ	1.32E+03	1.21E+03	0.00E+00	1.16E+02
Renewable primary energy carrier used	**RPRM**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable primary energy used as	**NRPRE**	MJ	2.00E+04	1.12E+04	4.29E+03	4.43E+03
Non-renewable primary energy used as	**NRPRM**	MJ	3.13E+02	3.13E+02	0.00E+00	0.00E+00
Secondary Material, Secondary Fuel and Recovered Energy						
Use of secondary materials	**SM**	kg	1.73E+03	1.73E+03	0.00E+00	0.00E+00
Use of renewable secondary fuels	**RSF**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	**NRSF**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy	**RE**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mandatory Inventory Parameters						
Use of freshwater resources	**FW**	m3	2.26E+02	8.67E+00	0.00E+00	2.17E+02
Indicators Describing Waste						
Disposed of hazardous waste	**HWD**	kg	1.35E+00	1.35E+00	0.00E+00	0.00E+00
Disposed of non-hazardous waste	**NHWD**	kg	5.74E+00	5.74E+00	0.00E+00	0.00E+00
Disposed of high-level radioactive waste	**HLRW**	m3	5.40E-04	5.39E-04	0.00E+00	9.24E-07
Disposed of low-level radioactive waste	**LLRW**	m3	1.48E-02	1.48E-02	0.00E+00	8.25E-06
Components for reuse	**CRU**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	**MFR**	kg	3.62E+01	3.62E+01	0.00E+00	0.00E+00
Materials for energy recovery	**MER**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy exported from the product system	**EE**	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 6. LCIA Results for 1 ton Helix® 5-25 BA Micro Rebar®						
Environmental Indicator	**Abbreviation**	**Units**	**Total**	**A1**	**A2**	**A3**
Core Mandatory Impact Indicator						
Global warming potential	**GWP**	kg CO2-eq	1.33E+03	8.33E+02	2.82E+02	2.10E+02
Depletion potential of the stratospheric	**ODP**	kg CFC-11-	2.72E-06	1.06E-09	1.19E-08	2.71E-06
Acidification potential of land and water	**AP**	kg SO2-eq	6.42E+00	2.12E+00	3.72E+00	5.76E-01
Eutrophication potential	**EP**	kg PO4-eq	4.14E-01	1.14E-01	2.16E-01	8.38E-02
Formation of tropospheric ozone	**SFP**	Kg O3-eq	1.49E+02	4.79E+01	9.58E+01	5.74E+00
Abiotic depletion potential for fossil	**ADPF**	MJ Surplus	7.49E+03	9.95E+02	4.04E+03	2.45E+03
Fossil Fuel Depletion	**FFD**	MJ Surplus	8.33E+02	0.00E+00	5.98E+02	2.35E+02
Use of Primary Resources						
Renewable primary energy carrier used as energy	**RPRE**	MJ	1.26E+03	1.14E+03	0.00E+00	1.16E+02
Renewable primary energy carrier used	**RPRM**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable primary energy used as	**NRPRE**	MJ	1.94E+04	1.06E+04	4.29E+03	4.43E+03
Non-renewable primary energy used as	**NRPRM**	MJ	2.97E+02	2.97E+02	0.00E+00	0.00E+00
Secondary Material, Secondary Fuel and Recovered Energy						
Use of secondary materials	**SM**	kg	1.64E+03	1.64E+03	0.00E+00	0.00E+00
Use of renewable secondary fuels	**RSF**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	**NRSF**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy	**RE**	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mandatory Inventory Parameters						
Use of freshwater resources	**FW**	m3	2.26E+02	8.21E+00	0.00E+00	2.17E+02
Indicators Describing Waste						
Disposed of hazardous waste	**HWD**	kg	1.28E+00	1.28E+00	0.00E+00	0.00E+00
Disposed of non-hazardous waste	**NHWD**	kg	5.43E+00	5.43E+00	0.00E+00	0.00E+00
Disposed of high-level radioactive waste	**HLRW**	m3	5.11E-04	5.10E-04	0.00E+00	9.24E-07
Disposed of low-level radioactive waste	**LLRW**	m3	1.41E-02	1.40E-02	0.00E+00	8.25E-06
Components for reuse	**CRU**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	**MFR**	kg	3.42E+01	3.42E+01	0.00E+00	0.00E+00
Materials for energy recovery	**MER**	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy exported from the product system	**EE**	MJ, NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00

5. Interpretation

Figure 2 shows the relative contribution to the cumulative impacts of the A1 through A3 phases of the cradle-to-gate life cycle. For GWP the biggest contribution comes from the A1 phase. Therefore, raw materials account for the majority of this impact category. A2 – Transportation is also driving a large amount of the impacts for GWP as well as across other indicators (AP, EP, SFP, and ADPF).

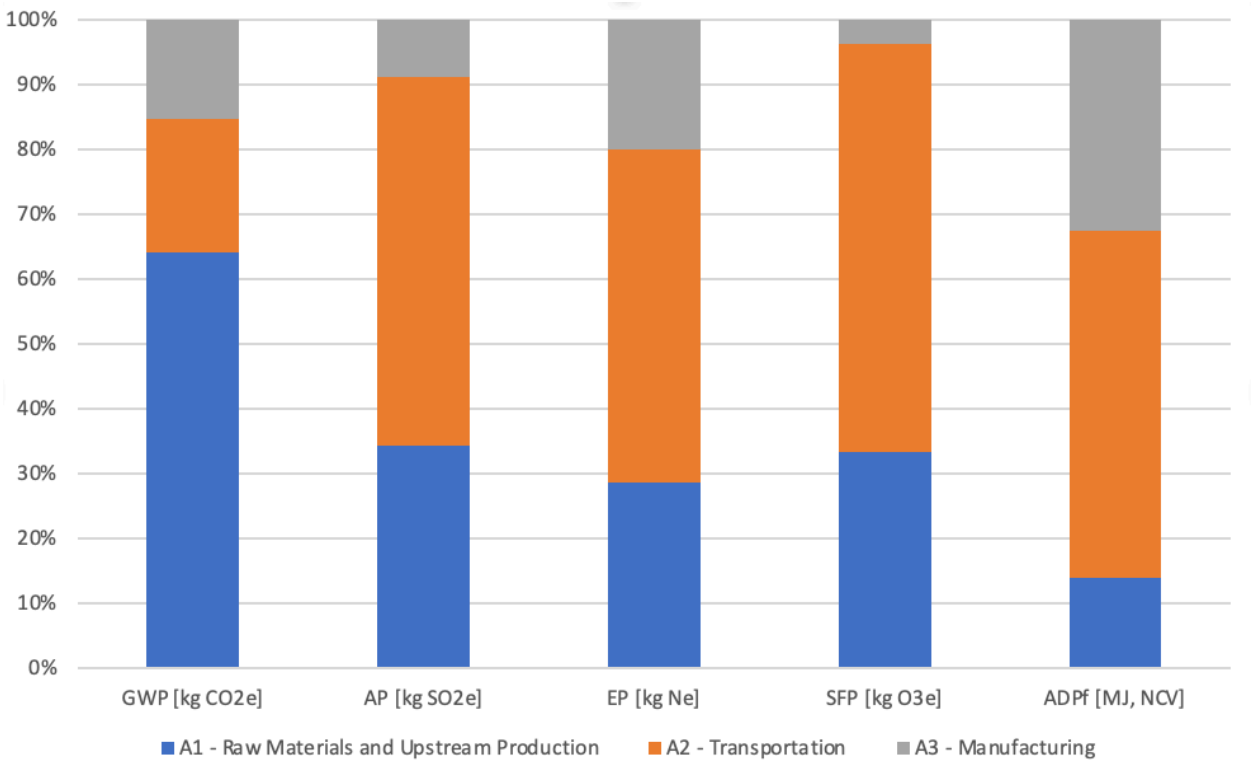

Figure 2. Contribution analysis for Helix® 5-25 BAZ and Helix® 5-25 Z Micro Rebar®.

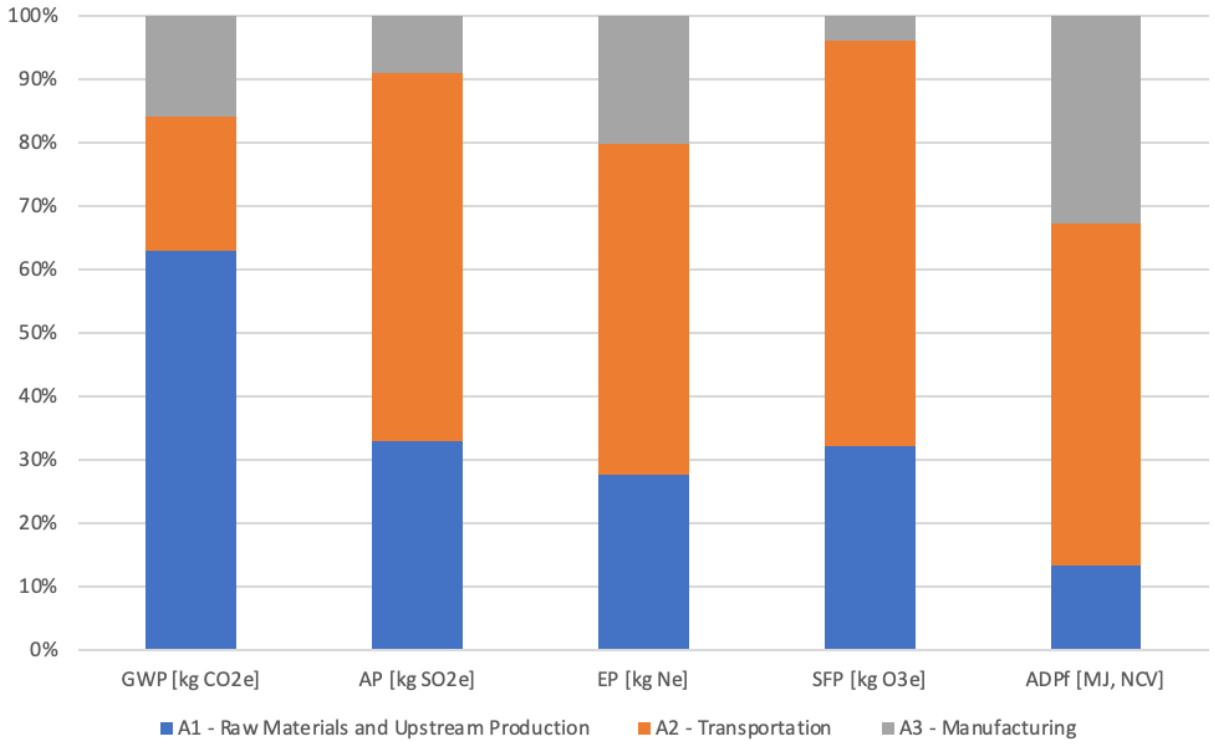

Figure 3. Contribution analysis for Helix® 5-25 BA Micro Rebar®.

6. References

1. ASTM 2020 - ASTM Program Operator for Product Category Rules (PCR) and Environmental Product Declarations (EPDs) General Program Instructions v8, April 29th.

2. WAP Sustainability: 2023 - A Cradle-to-Gate Life Cycle Assessment of Helix® 5-25 Micro Rebar® BAZ and Helix® 5-25 Micro Rebar® Z Manufactured by Helix Steel.

3. ISO 21930: 2017 Building construction – Sustainability in building construction – Environmental declaration of building products.

4. ISO 14025: 2006 Environmental labeling and declarations - Type III environmental declarations - Principles and procedures.

5. ISO 14044:2006/AMD 1:2017/ AMD 2:2020 - Environmental management - Life cycle assessment - Requirements and guidelines.

6. 14040:2006/AMD 1:2020 - Environmental management - Life cycle assessment - Principles and framework.