

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND EN 15804+A2

SmartEPD-2024-041-0189-01

Engineered Cast Steel Products



Date of Issue:
Oct 16, 2024

Expiration:
Oct 16, 2029

Last updated:
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General Information

Cast Connex Corporation

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Product Name:	Engineered Cast Steel Products
Declared Unit:	1 tonne
Declaration Number:	SmartEPD-2024-041-0189-01
Date of Issue:	October 16, 2024
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EPD Scope:	Cradle to gate with other options A1 - A3, C1 - C4, D
Market(s) of Applicability:	Europe, United Kingdom of Great Britain and Northern Ireland

Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2017, opt. EN 15804+A2
Core PCR:	Smart EPD® Part A Product Category Rules for Building and Construction Products and Services v.1.01 Date of issue: January 15, 2024 Valid until: January 15, 2029
Sub-category PCR review panel:	 Contact Smart EPD for more information.
General Program Instructions:	 Smart EPD General Program Instructions v.1.0, November 2022

Verification Information

LCA Author/Creator:	 Maria Amaya  maria.amaya@beath.us
EPD Program Operator:	 Smart EPD  info@smartepd.com  www.smartepd.com  585 Grove St., Ste. 145 PMB 966, Herndon, VA 20170, USA

Verification:

Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071 :

External

 Lindita Bushi |  Athena Sustainable Materials Institute |

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Independent external verification of EPD, according to ISO 14025 and reference PCR(s) :

External

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Limitations, Liability, and Ownership

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the whole building life cycle. EPD comparability is only possible when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. The EPD owner has sole ownership, liability, and responsibility for the EPD.

A manufacturer shall not make claims based on an industry-average EPD which leads the market to believe the industry-average is representative of manufacturer-specific or product-specific results.

Organization Information

Cast Connex Corporation (CAST CONNEX) is a supplier of Engineered cast steel products, leveraging a global supply chain of trusted steel foundry partners to manufacture the components that CAST CONNEX designs. CAST CONNEX products are used in the construction of buildings, bridges, and other structures all over the world.

Further information can be found at: castconnex.com

Product Description

CAST CONNEX standard and custom steel connectors are used in architectural applications for buildings and bridges to provide structural performance, attractive appearance, and construction economy. CAST CONNEX products are often used for geometrically complex connections, heavily loaded connections, connections with special loading conditions, and applications in which connections are left exposed and appearance is important. The product is made from casted steel, mainly from recycled steel scrap, with a density of approximately 7800 kg/m³.

Further information can be found at: castconnex.com

Product Information

Declared Unit:	1 tonne
Mass:	1000 kg
Product Specificity:	☒ Product Average
	☐ Product Specific

Plants



Electro Aco Altona S.A.
Rua Engenheiro Paul Werner, 925 - Itoupava Seca, Blumenau - State of Santa Catarina, Brazil

Product Specifications

Product Classification Codes:	UNSPSC - 31101620
	UNSPSC - 31121203
	Masterformat - 05 12 00
	Masterformat - 05 13 00
	EC3 - Steel

Material Composition

Material/Component Category	Origin	% Mass
Steel	None	98
Alloying Elements	None	2

Packaging Material	Origin	kg Mass
Wood Pallets	None	6
Plastic Banding	None	0.004
Plastic Bag	None	0.5

Hazardous Materials
None

EPD Data Specificity

Primary Data Year:	2021
Manufacturing Specificity:	✗ Industry Average ✗ Manufacturer Average ✓ Facility Specific

Averaging:
Averaging was not used for this EPD.

Software and LCI Data Sources

LCA Software:	GaBi v. 10.0
LCI Foreground Database(s):	Ecoinvent v. 3.8 Cut-off by Classification
LCI Background Database(s):	Ecoinvent v. 3.8 Cut-off by Classification

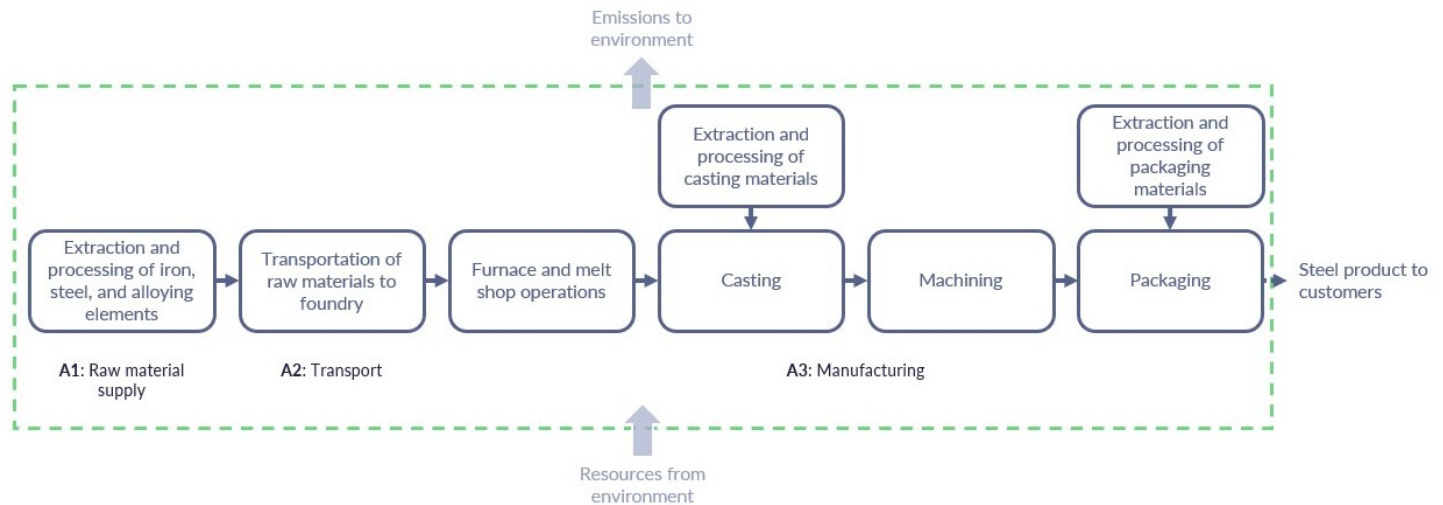
Renewable Electricity

Energy Attribute Certificates (EACs) such as Renewable Energy Certificates (RECs) or Power Purchase Agreements (PPAs) are included in the baseline reported results:	No
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System Boundary

Production	A1	Raw material supply	✓
	A2	Transport	✓
	A3	Manufacturing	✓
Construction	A4	Transport to site	ND
	A5	Assembly / Install	ND
Use	B1	Use	ND
	B2	Maintenance	ND
	B3	Repair	ND
	B4	Replacement	ND
	B5	Refurbishment	ND
	B6	Operational Energy Use	ND
	B7	Operational Water Use	ND
End of Life	C1	Deconstruction	✓
	C2	Transport	✓
	C3	Waste Processing	✓
	C4	Disposal	✓
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	✓

Product Flow Diagram



Life Cycle Module Descriptions

The cast steel manufacturing process starts with design and structural analysis, which is followed by design for manufacturing, pattern manufacturing, and sand molding. Once the molds are prepared, scrap and other inputs are selected. This process uses an Electric Arc Furnace (EAF) to melt and pour the steel. When the steel is set, it is fettled, inspected, machined, inspected again, and sent out. The process at Altona is powered by electricity sourced from the grid in Brazil and produces high quality cast steel construction products from scrap steel and various alloying elements.

Once the product is set to be processed for end of life, the surrounding building is demolished and the steel is recovered. The recovered steel is then mostly recycled and recovered, with a small amount being sent to landfill.

LCA Discussion

Allocation Procedure

In the steelmaking process, slag is typically considered a co-product. The slag is allocated using economic allocation per EN 15804 requirements. However, no allocation was applied as Altona pays a third party to recycle its slag in Brazil.

End-of-life allocation is included in the system boundary. End-of-life allocation was calculated using disposition rates from the 2012 EUROFER survey for light structural steel. This survey informed both Modules C and D. The World Steel Association (worldsteel) provided its Value of Scrap LCI dataset (exported to be in line with ecoinvent v3.8) for modeling end of life scrap recycling. The net scrap was calculated and then multiplied by the worldsteel Value of Scrap dataset, which represents the difference in impacts of steel production using a theoretical 100% virgin iron input and 100% scrap based steel production accounting for the yield. Net scrap was calculated by subtracting the amount of scrap fed into the system from the amount of scrap leaving the system.

Cut-off Procedure

No cut-off criteria were defined for this analysis. All available energy and material flow data were included in accordance with the system boundary. Proxy data were used as needed in the model to capture all considered life cycle impacts.

Data Quality Discussion

All raw material input data, production process, packaging, utility, and waste data is primary data that was collected from Altona. This primary data also applies for all transportation. For the life cycle inventory modelling of the process inputs and outputs, secondary data was used from ecoinvent v3.8. Data quality was evaluated for

the following parameters: time-related coverage, geographical coverage, technology coverage, precision, completeness, representativeness, consistency, reproducibility, sources of the data, and uncertainty of the information. Data was deemed to be representative and of sufficient quality across all parameters.

Results

Environmental Impact Assessment Results

IPCC AR5 GWP 100, EF 3.1

per 1 tonne of product.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact Category	Method	Unit	A1A2A3	C1	C2	C3	C4	D
GWP-total	IPCC AR5 GWP 100	kg CO2 eq	1760	2.22	10.7	ND	ND	86.3
GWP-fossil	IPCC AR5 GWP 100	kg CO2 eq	1270	2.22	10.6	ND	ND	86.8
GWP-biogenic	IPCC AR5 GWP 100	kg CO2 eq	420	0.000746	0.0285	ND	ND	-0.512
GWP-luluc	IPCC AR5 GWP 100	kg CO2 eq	70.5	0.000222	0.0728	ND	ND	0.0116
ODP	EF 3.1	kg CFC 11 eq	0.000111	4.79e-7	0.00000227	ND	ND	-1.17e-10
AP	EF 3.1	mol H+ eq	9.17	0.0233	0.0591	ND	ND	0.212
EP-marine	EF 3.1	kg N eq	1.75	0.0103	0.0211	ND	ND	0.0341
EP-terrestrial	EF 3.1	mol N eq	18.3	0.113	0.227	ND	ND	0.306
POCP	EF 3.1	kg NMVOC eq	4.54	0.0311	0.0657	ND	ND	0.139
ADP-minerals&metals	EF 3.1	kg Sb eq	0.0584	0.00000115	0.0000366	ND	ND	0.000492
ADP-fossil	EF 3.1	MJ	20200	30.6	164	ND	ND	863
WDP	EF 3.1	m3 world eq de- prived	4050	0.0753	0.923	ND	ND	5.86
EP-freshwater	EF 3.1	kg PO4 eq	0.384	0.0000694	0.000885	ND	ND	0.0000202
PM	EF 3.1	Disease incidence	0.000167	6.17e-7	9.49e-7	ND	ND	0.00000199
IRP	EF 3.1	kBq U235 eq	175	0.139	0.762	ND	ND	-1.95
ETP-fw	EF 3.1	CTUe	5820	8.17	57.6	ND	ND	45.3
HTP-c	EF 3.1	CTUh	0.00000691	6.97e-10	5.16e-9	ND	ND	-3.55e-8
HTP-nc	EF 3.1	CTUh	0.0000115	3.97e-9	1.07e-7	ND	ND	-1.69e-7
SQP	EF 3.1	dimensionless	7200	3.85	146	ND	ND	11.2

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

GWP = Global Warming Potential, 100 years (may also be denoted as GWP-total, GWP-fossil (fossil fuels), GWP-biogenic (biogenic sources), GWP-luluc (land use and land use change)), ODP = Ozone Depletion Potential, AP = Acidification Potential, EP = Eutrophication Potential, SFP = Smog Formation Potential, POCP = Photochemical oxidant creation potential, ADP-Fossil = Abiotic depletion potential for fossil resources, ADP-Minerals&Metals = Abiotic depletion potential for non-fossil resources, WDP = Water deprivation potential, PM = Particular Matter Emissions, IRP = Ionizing radiation, human health, ETP-fw = Eco-toxicity (freshwater), HTP-c = Human toxicity (cancer), HTP-nc = Human toxicity (non-cancer), SQP = Soil quality index.

Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930 or EN 15804. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

Resource Use Indicators

per 1 tonne of product.

Indicator	Unit	A1A2A3	C1	C2	C3	C4	D
PERE	MJ, LHV	15900	0.173	3.28	ND	ND	-34.1
PERM	MJ, LHV	ND	ND	ND	ND	ND	ND
PERT	MJ, LHV	15900	0.173	3.28	ND	ND	-34.1
PENRE	MJ, LHV	20200	30.6	164	ND	ND	864
PENRM	MJ, LHV	ND	ND	ND	ND	ND	ND
PENRT	MJ, LHV	20200	30.6	164	ND	ND	864
SM	kg	9.5	ND	ND	ND	ND	ND
RSF	MJ, LHV	ND	ND	ND	ND	ND	ND
NRSF	MJ, LHV	ND	ND	ND	ND	ND	ND
FW	m3	94.3	0.00175	0.0215	ND	ND	8.78

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

RPRE or PERE = Renewable primary resources used as energy carrier (fuel), RPRM or PERM = Renewable primary resources with energy content used as material, RPRT or PERT = Total use of renewable primary resources with energy content, NRPRE or PENRE = Non-renewable primary resources used as an energy carrier (fuel), NRPRM or PENRM = Non-renewable primary resources with energy content used as material, NRPRT or PENRT = Total non-renewable primary resources with energy content, SM = Secondary materials, RSF = Renewable secondary fuels, NRSF = Non-renewable secondary fuels, RE = Recovered energy, ADPF = Abiotic depletion potential, FW = Use of net freshwater resources, VOCs = Volatile Organic Compounds.

Waste and Output Flow Indicators

per 1 tonne of product.

Indicator	Unit	A1A2A3	C1	C2	C3	C4	D
HWD	kg	ND	ND	ND	ND	ND	ND
NHWD	kg	259	ND	ND	ND	ND	10.4
RWD	kg	ND	ND	ND	ND	ND	ND
CRU	kg	ND	ND	ND	ND	ND	ND
MFR	kg	456	ND	ND	40	ND	ND
MER	kg	ND	ND	ND	940	ND	ND
EEE	MJ	ND	ND	ND	ND	ND	ND
EET	MJ	ND	ND	ND	ND	ND	ND

Note:

Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:

HWD = Hazardous waste disposed, NHWD = Non-hazardous waste disposed, RWD = Radioactive waste disposed, HLRW = High-level radioactive waste, ILLRW = Intermediate- and low-level radioactive waste, CRU = Components for re-use, MFR or MR = Materials for recycling, MER = Materials for energy recovery, MNER = Materials for incineration, no energy recovery, EE or EEE = Recovered energy exported from the product system, EET = Exported thermal energy.

Carbon Emissions and Removals
per 1 tonne of product.

Indicator	Unit	A1A2A3	C1	C2	C3	C4	D
BCRP	kg CO2	ND	ND	ND	ND	ND	ND
BCEP	kg CO2	ND	ND	ND	ND	ND	ND
BCRK	kg CO2	ND	ND	ND	ND	ND	ND
BCEK	kg CO2	ND	ND	ND	ND	ND	ND
BCEW	kg CO2	ND	ND	ND	ND	ND	ND
CCE	kg CO2	ND	ND	ND	ND	ND	ND
CCR	kg CO2	ND	ND	ND	ND	ND	ND
CWNR	kg CO2	ND	ND	ND	ND	ND	ND

Note:
Not all abbreviated indicators listed below may be present in the results above. The inclusion of indicators varies based on PCR requirements.

Abbreviations:
BCRP = Biogenic Carbon Removal from Product, BCEP = Biogenic Carbon Emission from Product, BCRK = Biogenic Carbon Removal from Packaging, BCEK = Biogenic Carbon Emission from Packaging, BCEW = Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes, CCE = Calcination Carbon Emissions, CCR = Carbonation Carbon Removals, CWNR = Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes, GWP-luc = Carbon Emissions from Land-use Change.

Scenarios

End of Life

C1 - C4 Modules

Collection Process

Collected Separately: 1000 kg

Recovery

Reuse: 40 kg
Recycling: 940 kg
Landfill: 20 kg

Disposal

Product or Material for Final Disposal: 20 kg

Assumptions for scenario development:

At the end-of-life, the product is assumed to be 94% recycled, 2% landfilled, and 4% reused. This is based on the 2012 survey for light weight structural steel published by EUROFER.

Reuse, Recovery and / or Recycling Potentials & Relevant Scenario Information

D Module

Recycling Rate of Product: 94 %
Recycled Content of Product: 98 %

Interpretation

The results of the LCA indicate that the electricity is the largest contributor to the CAST CONNEX product footprint across most impact categories. Electricity contributes up to 73% of climate change impacts. Alloying element use is also a significant contributor, comprising the largest share of the Eutrophication Potential, freshwater (EPfw), Resource use, minerals and metals (ADPm), and Human toxicity, cancer (HTP-c) category results. Alloying element use is also a significant contributor. Impacts of the alloying elements used in cast steel produced at Altona are driven by manganese feedstocks. The direct emissions of the steelmaking process are small compared to the impact of raw material and energy use. The steel feedstock is a scrap product so the upstream burden is zero, therefore it does not contribute to the product footprint. Inbound transportation of the steel product to the foundry is included and is a small contributor to the product footprint. Impacts of deconstruction and end of life are driven by diesel and electricity use in the deconstruction (C1) module. Transport of materials to waste processing and end of life (C2) is small.

Module D results in a slight overall burden or slight benefit across the impact categories assessed. Given the majority of the product is scrap material, even with a demonstrated high recycling rate, slightly more scrap is consumed by the product system than is produced at end-of-life.

The study timeframe is for the year 2021 for Cast Connex manufacturing at Altona in Brazil. This study does not include comparisons or benchmarking. Environmental declarations from different programs based upon different PCRs may not be comparable.



Additional Environmental Information

The Electro Aço Altona S.A. environmental management system is in implementation as ISO 14001 certified (<https://www.altona.com.br/web/produtos/certificaes-altona>). The Electro Aço Altona S.A. occupational health and safety management system is in implementation as ISO 45001 certified (<https://www.altona.com.br/web/produtos/certificaes-altona>).

Cast steel is not readily susceptible to destruction due to fire, water, or mechanical effects. Unprotected cast steel will exhibit reduced strength at elevated temperatures, but is not consumed and does not fuel fire. Unprotected cast steel in the presence of water and oxygen is susceptible to degradation due to corrosion; the resulting oxide has low toxicity and environmental impact. Cast steel degraded by mechanical effects may result in low toxicity dust that causes physical irritation.

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