ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017

SmartEPD-2024-033-0161-01

Steelcon Open Web Steel Joists and Joist Girders

Steelcon

SMART EPD
CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION

Date of Issue: Aug 26, 2024

Expiration: Aug 26, 2029

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General Information

Steelcon

8100 Highway 27, Suite 401, Woodbridge, ON L4H 3N2

4167983343

info@steelcongoc.com steelcongoc.com

Product Name:	Steelcon Open Web Steel Joists and Joist Girders
Declared Unit:	1 t undefined
Declaration Number:	SmartEPD-2024-033-0161-01
Date of Issue:	August 26, 2024
Expiration:	August 26, 2029
Last updated:	August 26, 2024
EPD Scope:	Cradle to gate A1 - A3
Market(s) of Applicability:	North America

Reference Standards

Standard(s):	ISO 14025 and ISO 21930:2017
Core PCR:	UL PCR for Building-Related Products and Services Part A v.3.2 Date of issue: December 12, 2018
Sub-category PCR:	UL Part B: Designated Steel Construction Products v.2 Date of issue: December 31, 2020 Valid until: December 31, 2025
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:	Mandi Wesley | mandi.wesley@mantledev.com
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

Tom Etheridge | EarthShift Global | Thomas@earthshiftglobal.com

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

Tom Etheridge | EarthShift Global | Thomas@earthshiftglobal.com

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 environmental impact results of steel products in this document are based on a declared unit and therefore do not provide sufficient information to establish comparisons. The results shall not be used for comparisons without knowledge of how the physical properties of the steel product impact the precise function at the construction level. The environmental impact results shall be converted to a functional unit basis before any comparison is attempted. The EPD owner has sole ownership, liability, and responsibility for the EPD.

Organization Information

Steelcon is a group of structural steel companies that design, fabricate, and build industrial, commercial, institutional, and multi-residential projects. With more than 712,000 square feet of fabrication space across fve facilities strategically located in Canada and the U.S., combined with an unmatched in-house team of engineers, project managers, feld supervisors, and erectors, Steelcon provides the most innovative, highly engineered, and cost-effective structural steel solutions across the continent.

Further information can be found at: https://www.steelcongoc.com/

Product Description

Open web steel joists (OWSJs) and joist girders are fabricated steel truss members that are custom-engineered to suit the project-specific geometry, loading, and serviceability requirements for each application. OWSJs are secondary members supporting roof and floor decks, ranging from 254mm to 3048mm (10" to 120") deep and up to 53.35m (175') long. Joist girders are primary support members supporting secondary gravity framing, ranging from 508mm to 3048mm deep (20" to 120") and up to 36.576m (120') long.

Product Information

Declared Unit:	1 t undefined
Mass:	1000 kg
Product Specificity:	✗ Product Average
	✓ Product Specific

Averaging:

This LCA covers joist production within the 2023 calendar year at Steelcon's facility in Welland, Ontario, Canada, including upstream steel manufacturing at specified mills in Canada, the United States, Turkey, and Mexico. The geographical coverage for this study is based on Ontario-specific and Canadian data, where available, to model background processes in the LCA. North American data was used where processes occur across the continent, and global data was used as a proxy where regional-specific data is unavailable.

Steelcon estimated welding quantities per metric tonne of joist, choosing the average (mean) value as representative of a typical joist. Steelcon produces the joist in various sizes; however, all sizes follow the same process and are fabricated at the same facility. Thus, the material and energy required to fabricate each is proportional per tonne.

Six suppliers represented 99% of the upstream steel supply and represented Steelcon's joist steel supply in this study.

Plants

Steelcon Rusholme Shop
615 Rusholme Rd, Welland, ON L3B 5N7, Canada

Product Specifications

Product Classification Codes:	UNSPSC - 30103614
Form Factor:	Steel >> StructuralSteel
Steel Type:	Alloy
Yield Tensile Strength:	350 MPa

Material Composition

Material/Component Category	Origin	% Mass
Steel Angle	North America	53
Steel Angle	Turkey	47

Packaging Material	Origin	kg Mass
Steel Strapping	Samhwan Steel	0.57

Hazardous Materials
No regulated hazardous or dangerous substances are included in this product.

EPD Data Specificity

Primary Data Year:	2023
Manufacturing Specificity:	✗ Industry Average ✗ Manufacturer Average ✓ Facility Specific

Software and LCI Data Sources

LCA Software:	openLCA v. 2.0
LCI Foreground Database(s):	Ecoinvent v. 3.9.1 | Ontario, Canada | Cut-off
LCI Background Database(s):	Ecoinvent v. 3.9.1 | World | Cut-off

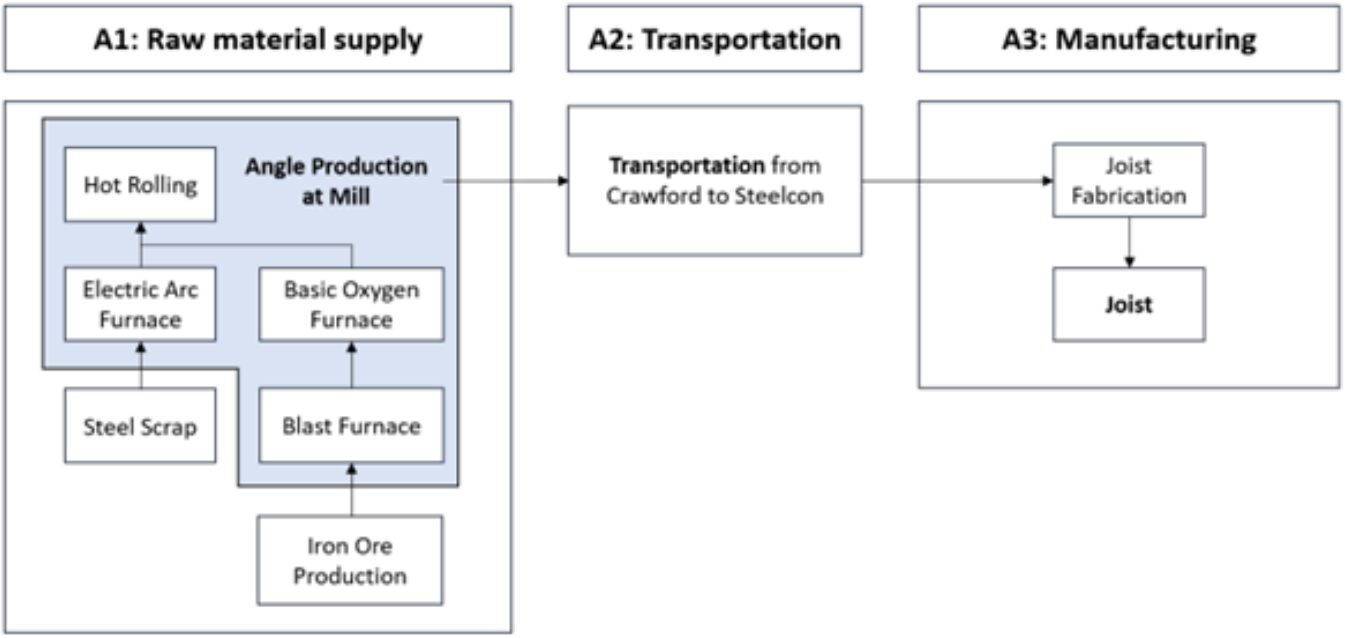
Renewable Electricity

Renewable electricity is used:	No

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	ND
	C2	Transport	ND
	C3	Waste Processing	ND
	C4	Disposal	ND
Benefits & Loads Beyond System Boundary	D	Recycling, Reuse Recovery Potential	ND

Product Flow Diagram



Life Cycle Module Descriptions

Raw Material Supply (A1)
This life cycle module covers the production of the steel angle used to create the joists, including the mining of minerals, intermediate transportation of steel from the service center (Crawford Supply), milling, and slitting. In each case, the distance between the mill and the service center and the proportion of steel attributable to each manufacturer was considered. In cases where steel is shipped from overseas, distances were found from the nearest port to the mill to the Port of Toronto.

Production processes were assigned for the other five steel mills according to their EPDs. The EPDs from Gerdau and Özkan indicate electric arc furnace (EAF) as the means of steel production (Özkan Steel, 2021; Garvey, 2021; Garvey, 2022a; Garvey, 2022b).

For Deacero steel, the source of steel is assumed to be recycled steel scrap rather than virgin material. The recycled steel is processed in an EAF to produce the final material, which is hot rolled before packaging and shipment to the steel service center.

Packaging (A1)
This includes the manufacturing of steel strapping for transporting the finished joists. The method of production for Samhwan steel strapping is unknown. Therefore, it's modeled as a generic steel production process that assumes a mix of EAF production and another mode of production it labels as a “converter.”

Transportation (A2)
Truck transportation delivers purchased steel products from the steel service center to Steelcon’s fabrication facility.

Fabrication and Priming (A3)
This life cycle module covers the fabrication and priming performed by Steelcon at their Welland facility to produce the final joist product. This involves cutting and welding sections of angle together (fabrication) to form the joist. Electricity consumption, covering the energy used to power Steelcon’s machinery and natural gas heating for the facility, is based on 2023-2024 data provided by Steelcon. Electricity consumption was adjusted to account for a fraction that Steelcon devoted to the joist line specifically.

LCA Discussion

Allocation Procedure

All allocation in this study comes from that inherent in ecoinvent 3.9.1. No additional allocation method was followed beyond that. Steelcon provided a breakdown of all service center steel purchased in 2023, separated by the steel mill's origin. Six suppliers represented 99% of the steel supply to the steel service center and were included in this study as representative of Steelcon’s joist steel supply. Five steel mills had Type III Product-specific EPDs, which were Özkan, Gerdau Whitby, Kocaer, Gerdau Cambridge, and Gerdau Jackson. One mill without a Type III Product EPD was Deacero, and it was assumed that it used an electric arc furnace for steel production (Taylor, 2018). Steel impacts were weighted by the proportion of steel coming from each mill.

All truck transportation distances were determined using Google Maps and were weighted by the share of steel from each mill and from Crawford’s facility to determine the weighted distance [tonnesteel * km]. The same approach was used to determine the transportation distance from the steel strapping production mill to the distributor, Bosch Construction & Industrial Supplies. Where steel came from overseas, SeaRates (SeaRates, n.d.) determined the maritime shipping distance to the Port of Toronto. Then steel is transported by truck to Crawford or Bosch.

For all electricity use in Ontario, the ecoinvent 3.9.1 process “market for electricity, medium voltage | electricity, medium voltage | EN15804, U - CA - ON” is used to model impacts (0.07634 kg CO2e / kWh). Ecoinvent 3.9 electricity generation data for Ontario is based on Statistics Canada generation data for 2020 (ecoinvent, n.d.). A generic electric steel production process was used to model Deacero steel located in Mexico, so the ecoinvent 3.9.1 process for the electricity input is “market for electricity, medium voltage | electricity, medium voltage | EN15804, U – MX” (0.63981 kg CO2e / kWh).

Cut-off Procedure

All known processes impacting the joist production were noted in this LCA report. No decisions were made to exclude any aspects from the analysis.

Data Quality Discussion

An evaluation of the data quality is described below.

Temporal

Primary and secondary data was used for the 2023 calendar year to represent the most up-to-date full year of production. Utility data was based on 2023/2024, reflecting the most recent available utility bills. As a result, the temporal representativeness is considered high.

Geographical
The majority of primary and secondary data were collected specific to the countries or regions specified in this study. Where feasible, Ontario-specific or Canadian-specific data was used for processes occurring at Steelcon's facility. Where country-specific or region-specific data were unavailable, proxy data was used. As a result, geographical representativeness is considered high.

Technological
The study aimed to model upstream manufacturing and fabrication processes specified by Steelcon. In cases where exact matches with ecoinvent could not be made, similar processes were modified to representative processes, or proxies were made. As a result, technological representativeness is considered high.

Results

Environmental Impact Assessment Results

IPCC AR5 GWP 100, TRACI 2.1, CML 2016

per 1 t 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	A1	A2	A3	A1A2A3
GWP-total	IPCC AR5 GWP 100	kg CO2 eq	864	13.6	25.9	904
ODP	TRACI 2.1	kg CFC 11 eq	0.0000568	2.24e-7	1.9e-7	0.0000572
AP	TRACI 2.1	kg SO2 eq	3.71	0.0578	0.0421	3.81
EP	TRACI 2.1	kg N eq	1.72	0.0131	0.0532	1.79
POCP	TRACI 2.1	kg O3 eq	39.7	1.59	0.694	42
ADP-fossil	CML 2016	MJ	9430	175	273	9880

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 t of product.

Indicator	Unit	A1	A2	A3	A1A2A3
PERE	MJ	1060	2.53	71.4	1140
PERM	MJ	ND	ND	ND	ND
PENRE	MJ	10200	178	395	10700
PENRM	MJ	104	16.6	12.9	134
SM	kg	542	0.146	0.292	542
RSF	MJ	0.18	0.0186	0.0753	0.274
NRSF	MJ	0.759	0.0779	0.274	1.11
RE	MJ	ND	ND	ND	ND
FW	m3	50.8	0.0246	0.519	51.4

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 t of product.

Indicator	Unit	A1	A2	A3	A1A2A3
HWD	kg	22.2	0.222	0.633	23.1
NHWD	kg	290	11.8	0.954	303
CRU	kg	ND	ND	ND	ND
MFR	kg	79.7	0.124	0.216	80
MER	kg	ND	ND	ND	ND
EEE	MJ, LHV	ND	ND	ND	ND
HLRW	kg	0.0784	0.0000121	0.00248	0.0809
ILLRW	kg	0.0373	0.000029	0.000843	0.0382

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.

Interpretation

The steel supply in life cycle module A1 dominated all impact categories included in this study, indicating the prominent role that steel milling plays in the environmental impacts of steel products. Transportation impacts were relatively minor due to generally short truck transportation distances and the lower-carbon-intensive marine transportation across long distances. The contributions of different mills to total GWP were roughly in proportion to the share of steel they supplied. While transportation from mill to service centers in A1 was only around 7% of GWP impacts, this is still greater than the A3 impacts of facility heating (1.48%), primer production (1.24%), net electricity consumption (0.10%), and welding (0.05%). The impact of fabrication at Steelcon is minor across most impact categories.

Overall, Steelcon's steel joists' impact is largely driven by steel sourcing. These results aim to represent Steelcon's open-web steel joist environmental impacts.

Further Information

Assumptions

- The analysis assumed the manufacturing processes of Deacero's steel, transportation types and distances, welding processes, and representative geographical data. Deacero did not have a product-specific EPD. The manufacturing process was assumed to be EAF since that mode of production was predominant among steel suppliers with EPDs. In addition, an online source stated that EAF capacity will be expanded at Deacero's facilities in Mexico (Taylor, 2023), suggesting EAF as its steel production. Deacero constitutes only 3.45% of Steelcon's steel supply for joists, so these assumptions will have minimal impact on the results.
- For transportation, the truck type and fuel were unknown. Therefore, a generic diesel freight process was used. Similarly for marine transport, generic marine transportation was assumed. North American truck transportation distances were measured using Google Maps, and marine distances and Korean truck transportation distances were measured using SeaRates (SeaRates, n.d.). The specific mill for the steel strapping was unknown. However, it was assumed it was sourced from Samhwan's Korean facility as Samhwan is a Korean company. Given the minimal impact of transportation on the results, achieving greater accuracy is unlikely to have a significant difference.
- It was assumed that the welding at Steelcon can be approximated using a modified ecoinvent MAG welding process, given that MAG welding shares many of the same inputs. While the impact of welding is not trivial, it is minimal and does not significantly contribute to overall uncertainty.
- RoW processes in OpenLCA were used where Canadian or North American-specific data was unavailable.

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