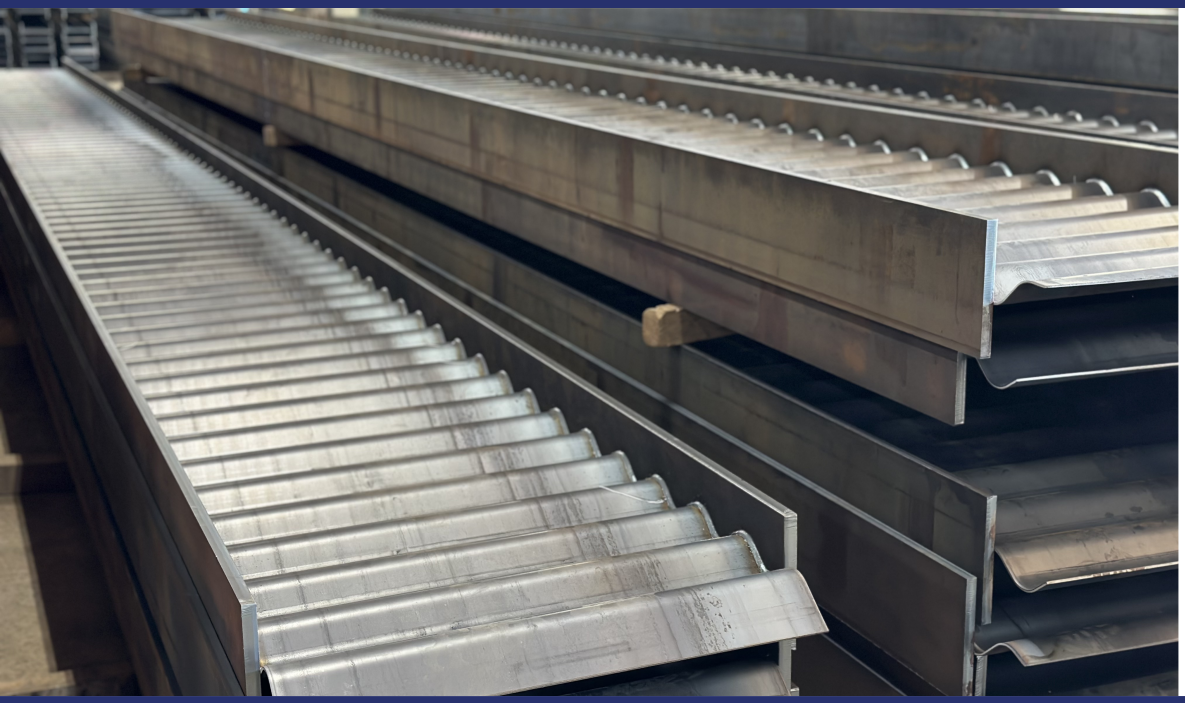
ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH ISO 14025 AND ISO 21930:2017

SmartEPD-2024-013-0046-01

Steelcon SIN Beam



Steelcon

SMART EPD CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION

Date of Issue: Jan 16, 2024

Expiration: Jan 16, 2029

Last updated: Jan 16, 2024

General Information

Steelcon

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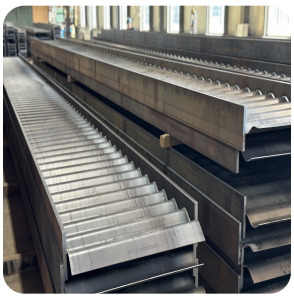

Product Name:	Steelcon SIN Beam
Declared Unit:	1 t
Declaration Number:	SmartEPD-2024-013-0046-01
Date of Issue:	January 16, 2024
Expiration:	January 16, 2029
Last updated:	January 16, 2024
EPD Scope:	Cradle to gate A1 - A3
Market(s) of Applicability:	North America

Reference Standards

Standard(s):	ISO 14025, ISO 14040, ISO 14044, ISO 21930:2017
Core PCR:	UL PCR for Building-Related Products and Services Part A v.3.2, ISO 21930:2017 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

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Verification:

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

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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 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 five facilities strategically located in Canada and the U.S., combined with an unmatched in-house team of engineers, project managers, field 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

The SIN Beam product is a structural steel section and may be used for flexural members such as roof or floor beams, as components subjected to axial loads such as columns, or as combined bending and axial members such as in moment frames or wind columns. The optimal application is an alternative to a rolled or welded wide flange shape, a joist, or a joist girder section with a depth between 300mm and 1800mm. SIN Beam is manufactured from 350W G40.21 steel (CSA Group, 2013).

Steelcon produces the SIN Beam in various sizes, from three sections of steel sheet joined together by welds. Two flat sections of sheet are used to form the parallel flanges of the beam, while the third section of sheet is cold formed into a sinusoidal ("SIN") shape and welded as the beam's web. This results in a light and efficiently manufactured steel beam with higher load capacity to weight ratio due to the sinusoidal shape and can reduce the amount of steel required in a structure by up to 30 per cent. No packaging is used for SIN Beam shipping, so packaging mass is not included.

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

Product Information

Declared Unit:	1 t
Mass:	1000 kg

Product Specificity:

- ✗ Product Average
- ✓ Product Specific

Averaging:

This EPD covers the fabrication of the SIN Beam within the 2022 calendar year at Steelcon's facility in St. Catharines, Ontario, Canada, including upstream manufacturing at specified mills in Canada and the USA. Canadian, especially Ontario-specific, data is preferred to align with the geographical coverage of most processes in the LCA. However, North American data was considered where processes occur across the continent, and global data was used as a proxy where regional-specific data is unavailable.

The length of a one metric ton beam varies from 3 meters (9.7 feet) to 54 meters (177 feet) depending on the proportions, with a median of 8.3 meters (27.3 feet). Where the size and proportions of the beam may impact the quantities of inputs, median beam data was chosen. This EPD is only for the SIN Beam made entirely from coil. Steelcon also manufactures heavy flange SIN Beams using plates for the flanges; however, since the focus is on a "typical" SIN Beam, these are excluded.

The most recent quarterly data showed that 94% of steel was supplied from the steel service center, Janco Steel, so it was assumed that Janco could represent the entire steel supply to Steelcon. Of that supply, the five most significant mills (95% of production) were assumed to represent the manufacturing impact.

Plants

Steelcon St. Catharines
87 Grantham Ave S, St. Catharines, ON L2P 3H3, Canada

Product Specifications

Product Classification Codes:	UNSPSC - 30101700 EC3 - Steel -> Structural Steel
Form Factor:	Steel >> Structural Steel
Steel Type:	Alloy
Yield Tensile Strength:	350 MPa

Material Composition

Material/Component Category	Origin	% Mass
Hot-Rolled Steel Coil	North America	100

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

EPD Data Specificity

Primary Data Year:	2022
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

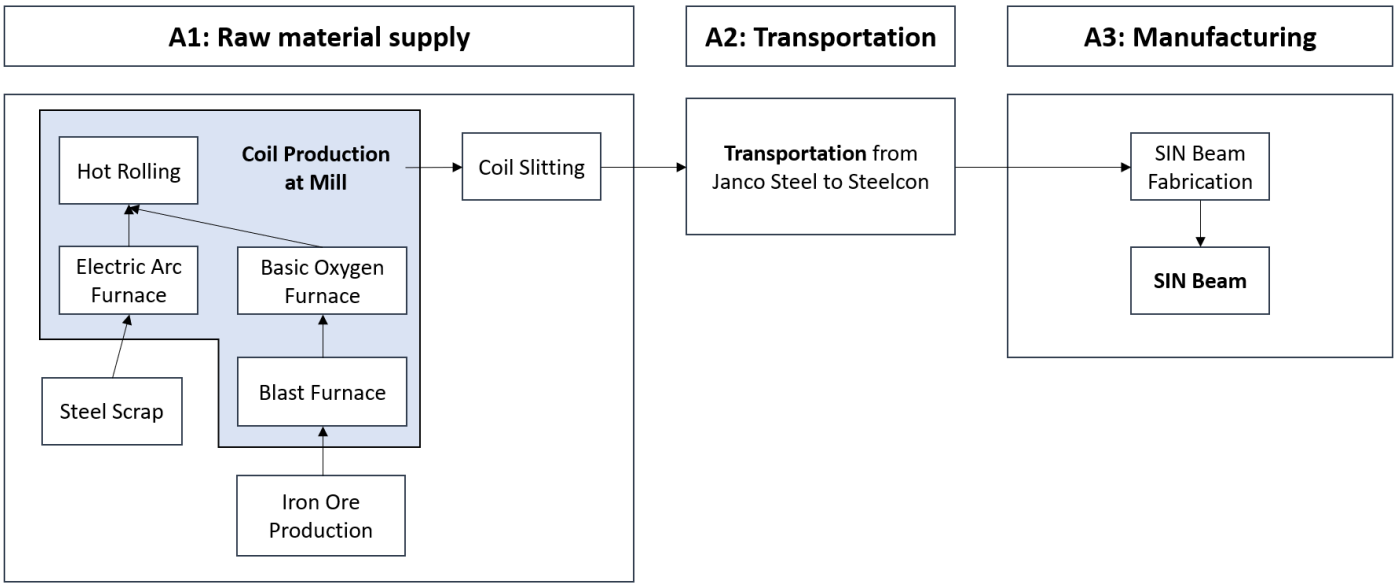
Renewable Electricity

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

A1

This module involves the production of the steel coil used to create the SIN Beam, including mining of minerals, intermediate transportation, milling, and slitting. The operations of both the steel mills and the service center are included in this step. Steelcon purchases all steel through steel suppliers. Since Janco Steel was responsible for the majority of SIN Beam steel sales (~94%), it was used as a representative supplier. The top five steel mills that account for the majority of sales to Steelcon are Nucor, EVRAZ, Algoma, Stelco, and ArcelorMittal Dofasco. EVRAZ and Nucor both have EPDs, which were used to manually assign the respective impacts into processes in OpenLCA. For the remainder of the manufacturers, it was determined that all manufacture steel through the blast furnace – basic oxygen furnace (BF–BOF) route. Electricity providers for this process were set to Ontario, and natural gas was localized to Canada. The hot rolling process in ecoinvent was modified to use Ontario electricity, and heat production was set to Quebec (the closest geographical data available in ecoinvent).

Slitting is performed at Janco on the steel coils. Since a lack of data on specific machinery or slitting data was available, an estimation of medium voltage Ontario electricity demand was made to represent the environmental impacts of coil slitting (given that the slitting machine consumes electricity and is located in Ontario). It was assumed that the slitting process of steel sheets could be represented based on the specifications of a researched slitting machine (Formetal Technology, n.d.).

Steel production and transportation impacts upstream of Steelcon and Janco are addressed through OpenLCA's ecoinvent processes and existing product EPDs covering A1-A3. Transportation of steel from mills to Janco is included in A1 and assumed to be by truck.

A2

Transportation from the steel service center, Janco Steel, to Steelcon's fabrication site. Transportation is assumed to occur via truck. Three transportation flows were created to represent transportation from Nucor, EVRAZ, and the remaining manufacturers. In each case, the distance between the mill and Janco and the proportion of steel attributable to each manufacturer was considered. For the remaining manufacturers, a weighted average of distances and weights was performed for the three largest manufacturers for which EPDs were not available to determine a representative transportation flow in tonne*km.

A3

This life cycle module involves welding sections of steel coil together (fabrication) at their St. Catharines facility to produce the SIN Beam. Electricity consumption and natural gas heating for the facility are based on 2022 annual data provided by Steelcon. Electricity is represented based on the medium voltage process from ecoinvent, which is specific to Ontario. Electricity consumption was adjusted to account for a fraction that Steelcon devoted to the SIN Beam line specifically.

The default heating process was used rather than the low Nox option supplied by ecoinvent since no indication of low Nox heating was given. The heating process from ecoinvent is modified such that the input electricity is Ontario market-specific. Heaters are only run from November to April, and 12-15% of the facility's heating

bill is attributable to Steelcon. Since 60% of the heaters are located specifically on the SIN Beam production line (as opposed to Steelcon's line for other components), the assignment of heating impacts was further reduced to account for this.

Emissions are released from Steelcon's facility directly because of arc welding, based on the MAG welding process in ecoinvent. The provided data for the weld gas used by Steelcon (Messer, n.d.a; Messer, n.d.b) is similar to the weld gas consumed in the OpenLCA MAG welding process.

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.

The total steel purchased in 2022 was used to specify the quantity of steel used for the SIN beam versus other steel products. Steel sales to Steelcon by the manufacturer for the first quarter of 2023 were used to assign impacts to specific steel mills. The majority of steel came from five suppliers and was assumed to represent Steelcon's steel supply. EPDs from the steel mills were obtained from the manufacturer or EPD databases. Two of the five mills had published EPDs, and the rest were contacted to confirm they use BF–BOF as their primary production method.

Transportation distances between Janco's facility (925 Arvin Ave, Stoney Creek, Ontario) and the locations of the five most prominent mills identified from Janco's purchase data were determined using Google Maps. These distances were weighted by the share of steel from each mill to determine a metric representing the multiple of weight and distance [tonne steel * km]. These values were included in the A1 phase associated with raw material and manufacture. Janco's facility was also used to determine transportation distances to Steelcon for module A2.

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.).

Cut-off Procedure

All known processes impacting the SIN Beam 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

Utility and steel purchase data were taken from the calendar year 2022 to represent the most up-to-date full year of production.

Geographical

Steelcon and Janco's facilities are both located in Ontario, Canada. As such, Ontario-specific data was either selected, or Canadian data was modified to be representative of Ontario to ensure the highest quality of data. Appropriate proxies were used based on data availability, such as Quebec data for heating processes.

Technological

The LCA sought to match the fabrication processes used by Steelcon and Janco. In cases where exact matches with ecoinvent could not be made, similar processes were modified to be closer to real-life processes, or proxies were made to represent likely energy consumption impacts.

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	Unit	A1	A2	A3	A1A2A3
GWP-total	kg CO2 eq	2.36e+3	6.04e+0	2.52e+1	2.39e+3
ODP	kg CFC 11 eq	7.60e-5	9.94e-8	0	7.61e-5
AP	kg SO2 eq	8.47e+0	2.57e-2	2.90e-2	8.52e+0
EP	kg N eq	7.87e+0	5.81e-3	2.00e-2	7.90e+0
POCP	kg O3 eq	1.56e+2	7.07e-1	6.55e-1	1.57e+2
ADP-fossil	MJ	2.30e+4	7.76e+1	3.37e+2	2.34e+4

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
RPRE	MJ	2.45e+3	1.12e+0	8.30e+1	2.53e+3
RPRM	MJ	7.20e+0	0	0	7.20e+0
NRPRE	MJ	2.41e+4	7.88e+1	8.19e+2	2.50e+4
NRPRM	MJ	7.60e+2	7.36e+0	1.60e+1	7.83e+2
SM	kg	2.36e+2	6.47e-2	8.64e-1	2.37e+2
RSF	MJ	4.23e+0	8.27e-3	2.45e-1	4.48e+0
NRSF	MJ	2.83e+1	3.46e-2	4.11e-1	2.87e+1
RE	MJ	0	0	0	0
FW	m3	2.53e+1	1.09e-2	1.56e+0	2.69e+1

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	5.92e+2	9.84e-2	9.12e-1	5.93e+2
NHWD	kg	3.17e+2	5.26e+0	1.42e+0	3.24e+2
CRU	kg	0	0	0	0
MFR	kg	2.81e+2	5.51e-2	7.01e-1	2.82e+2
MER	kg	0	0	0	0
HLRW	kg	2.98e-2	2.78e-5	1.00e-2	3.98e-2
ILLRW	kg	7.28e-2	2.50e-6	3.39e-3	7.62e-2
EE	MJ	0	0	0	0

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 impact of A2 transportation and A3 fabrication at Steelcon is minor across most impact categories examined. The A1 phase dominated across all impact categories, indicating the prominent role that steel milling plays in the environmental impacts of steel products. Steel production via the BF-BOF route predominated in terms of impacts. However, it should be noted that even EAF scrap production had a sizeable impact. The LCA shows that the majority of GHG emissions associated with the SIN Beam can be traced upstream to the method of steel milling.

Several assumptions were made in the analysis. As discussed previously regarding steel origins, the most recent quarterly data showed that 94% of steel was supplied from Janco, so it was assumed that Janco could represent the entire steel supply to Steelcon. Of that supply, the five most significant mills (95% of production) can represent the manufacturing impact. In terms of transportation, a generic freight process was used, given the lack of detail regarding the specific truck type used in transportation. Given the very minor degree that transportation indicated in the results, it would not be likely that greater accuracy here would yield a meaningful difference. It was also assumed that the welding at Steelcon can be approximated using a modified ecoinvent MAG welding process and that slitting can be represented as an impact on electricity consumption. While the impact of welding is not trivial, it is still so minor as not to represent a major source of uncertainty.

In places where this LCA is limited by the lack of geographical specificity in ecoinvent, RoW (Rest of World) processes had to be used in place of Canadian or North American-specific data.

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