Environmental Product Declaration

Statement of Verification

CARES EPD No.: 0037

Issue 01

This is to verify that the

Environmental Product Declaration

Provided by:

Fushun New Steel Corporation Ltd.

Is in accordance with the requirements of:
EN 15804:2012 + A2:2019 and EN ISO 14025:2010
and BRE Global PCR for Type III EPD of Construction Products to EN 15804+A2. PN514 3.1

This declaration is for:

Carbon Steel Billet (Primary production route – Iron Ore)

Company address:

No. 18, Shenfu Road, Wanghua District, Fushun, Liaoning

China

LadinCamci	Ladin Camci	14 October 2025
Signed for CARES	Operator	Date of this Issue
14 October 2025		13 October 2028
First Issue Date		Expiry Date

The validity of this Environmental Product Declaration can be verified by contacting CARES on +44 (0)1732 450 000 or visiting CARES website https://www.carescertification.com/certification-schemes/environmental-product-declarations.

CARES, Pembroke House, 21 Pembroke Road, Sevenoaks, Kent TN13 1XR

Environmental Product Declaration

EPD Number: CARES EPD 0037

General Information

EPD Programme Operator	CARES Pembroke House, 21 Pembroke Road, Sevenoaks, Kent, TN13 1XR UK www.carescertification.com
Applicable Product Category Rules	BRE Global Product Category Rules (PCR) for Type III EPD of Construction Products to EN 15804+A2. PN514 3.1
Commissioner of LCA study	CARES Pembroke House, 21 Pembroke Road, Sevenoaks, Kent, TN13 1XR UK www.carescertification.com
LCA consultant/Tool	CARES EPD Tool v2.8 SPHERA SOLUTIONS UK LIMITED The Innovation Centre Warwick Technology Park, Gallows Hill, Warwick, Warwickshire CV34 6UW UK www.sphera.com
Declared/Functional Unit	Declared Unit 1 tonne of carbon steel billet manufactured by the blast furnace/basic oxygen furnace (BF/BOF) production route
Applicability/Coverage	Manufacturer-specific product produced at a single plant of one manufacturer
EPD Type	Cradle to Gate with Modules C1-C4 and Module D
Background database	MLC (GaBi) Databases 2025.1 (Sphera, 2025)

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐Internal ☒ External
(Where appropriate [b]) Third party verifier: Dr Jane Anderson
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability

Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product Stage			Construction Stage		Use Stage							End-of-life Stage				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, Recovery and/or Recycling potential
✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	✓	✓	✓	✓	✓

Note: Checks indicate the Information Modules Declared, ND indicates Not Declared.

Manufacturing site

Fushun New Steel Corporation Ltd.
No. 18, Shenfu Road, Wanghua District,
Fushun, Liaoning
China

Construction Product:

Product Description

Carbon Steel Billet is non-alloy or low-alloy steel semi-product. Steel Billets (according to product standards listed in Summary, Comments and Additional Information) that are manufactured via the blast furnace/basic oxygen furnace route (BF/BOF), followed by continuous casting.

Carbon steel billet is produced for hot rolling to obtain reinforcing steel bars for direct use, or to obtain wire rod to produce other reinforcing steels by further processing, or to obtain other forms of structural steels.

The declared unit is 1 tonne of carbon steel billet manufactured from the blast furnace/basic oxygen furnace (BF/BOF) production route.

Technical Information

Property	Value, Unit
Production route	BF-BOF
Density	7850 kg/m^3
Recycled content (as per ISO 14021:2016/Amd:2021)	7.9 (Including internal and external scrap) 6.2 (Including external scrap only)

Technical Information details are as per relevant product standards listed in References section

Main Product Contents

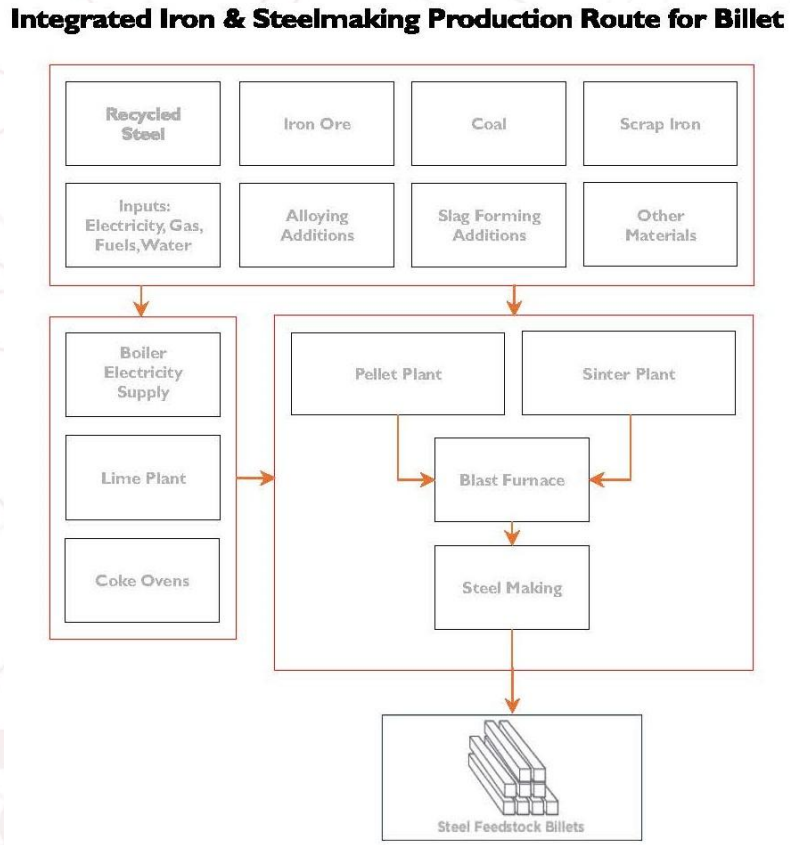
Material/Chemical Input	%
Fe	97
C, Mn, Si, V, Ni, Cu, Cr, Mo and others	3

Manufacturing Process

Integrated steelworks are complicated operations comprising multiple production processes as described below.

- Boilers/CHP: generates the steam used on site and some of the electricity (the remainder is sourced from the production mix of Northeast China grid). This process also supplies the blast air used in the blast furnace.
- Air separation unit: generates the gases and compressed air used in the production process (e.g. nitrogen, oxygen, hydrogen, argon, etc.).
- Lime plant: converts limestone and dolomite into lime/dololime for use in the basic oxygen furnace and sinter plant.
- Coke ovens: converts coking coal into coke that is used as a reducing agent in the blast furnace and as a fuel in the sinter plant. Various co-products are generated from this process including coke oven gas (used as a fuel elsewhere on site), benzene, ammonium sulphate, sulphuric acid and tar.
- Sinter plant: agglomerates iron ore fines with other materials (e.g. lime and limestone) to form nodules of iron rich material that are suitable for charging into the blast furnace.
- Blast furnace: ferrous rich materials (sinter, iron ore, pellets and steel scrap), slag-forming materials (such as limestone), reducing agents (such as coke) and fuels (such as blast furnace gas and natural gas) with process gases and blast air generates molten iron ("hot metal") and slag and blast furnace gas (which is used as fuel in various site operations). The hot metal also undergoes desulphurisation to remove this unwanted element from the product.
- Steelmaking: covers the basic oxygen furnace (BOF) and secondary steelmaking steps in which the carbon content of the hot metal is reduced, and alloying materials are added to give the desired physical properties to the finished steel, which are formed into billets. BOF gas is also generated and is used as a fuel in various site operations). Slags are also generated from these processes, some of which are recycled in the sinter plant.

Process flow diagram



Construction Installation

Processing and proper use of reinforcing steel and structural steel products manufactured from carbon steel billets depends on the application and should be made in accordance with generally accepted practices, standards and manufacturing recommendations.

During transport and storage of carbon steel billets and reinforcing steel and structural steel products manufactured from them the usual requirement for securing loads is to be observed.

Use Information

The composition of the reinforcing steel and structural steel products manufactured from carbon steel billets does not change during use.

Carbon steel reinforcing steel and structural steel products do not cause adverse health effects under normal conditions of use.

No risks to the environment and living organisms are known to result from the mechanical destruction of the reinforcing steel product itself.

End of Life

Reinforcing steel and other structural steel products manufactured from carbon steel billets are not reused at end of life but can be recycled to the same (or higher/lower) quality of steel depending upon the metallurgy and processing of the recycling route.

It is a high value resource, so efforts are made to recycle steel scrap rather than disposing of it at EoL. A recycling rate of 95% is typical for reinforcing steel products

Life Cycle Assessment Calculation Rules

Declared unit description

The declared unit is 1 tonne of carbon steel billet manufactured by the blast furnace/basic oxygen furnace (BF/BOF) production route

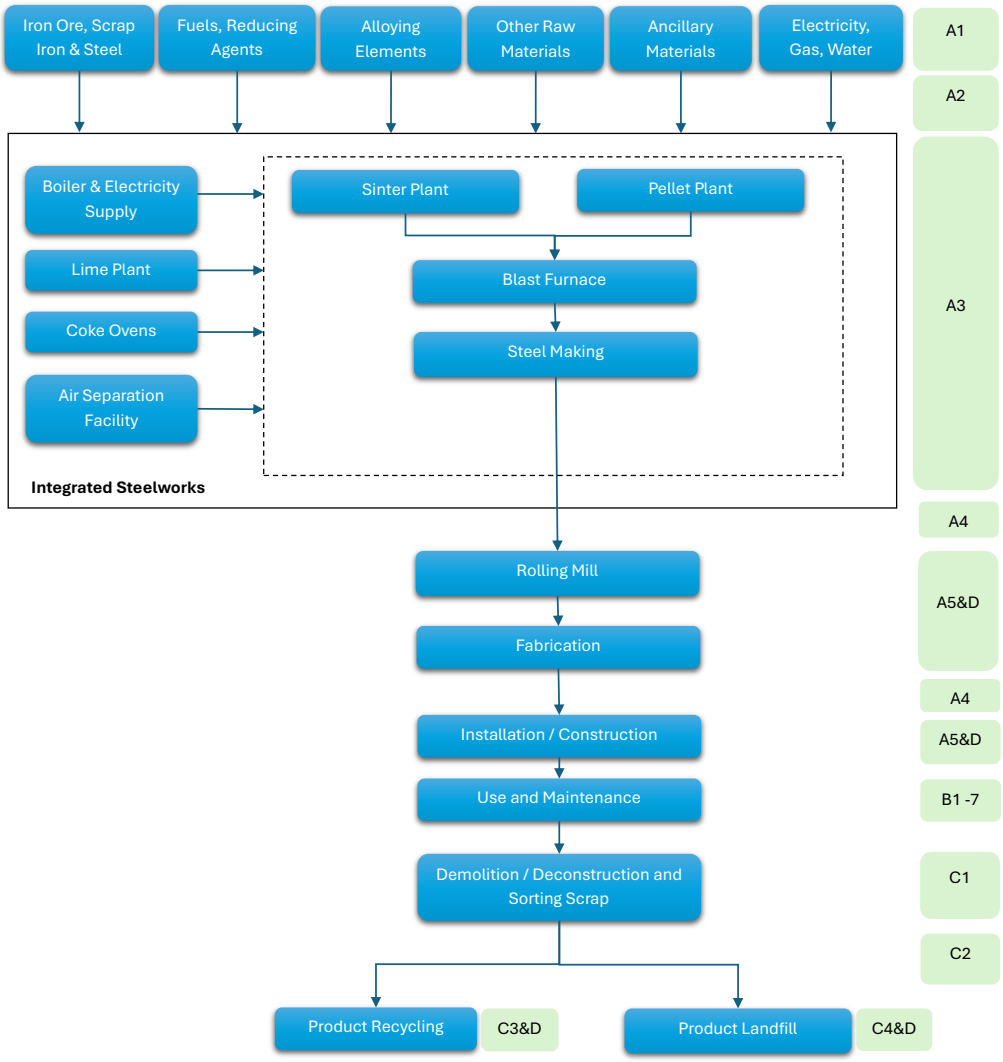
System boundary

The system boundary of the EPD follows the modular design defined by EN 15804+A2. Type of this EPD is cradle to gate – with modules A1 to A3, modules C1-C4 and module D.

Impacts and aspects related to losses/wastage (i.e. production, transport and waste processing and end-of-life stage of lost waste products and materials) are considered in the modules in which the losses/wastage occur.

Once steel scrap has been collected for recycling it is considered to have reached the end of waste state.

Overview of Product System for Carbon Steel Billet



Data sources and quality

The selection of data and the data quality requirements have been provided according to the requirements of BS EN 15941:2024.

Manufacturing data of the period 01/01/2024 – 31/12/2024 has been provided by Fushun New Steel Corporation Ltd operating on the geographical area noted in Manufacturing Site. A brief description of technology and inputs for the product is given in Manufacturing Process and in simplified Process Flow Diagram.

The primary data collection was thorough, considering all relevant flows and these data were verified during the audit conducted by CARES in July 2025, including also the verification of mass balance, to ensure that data for all the inputs and outputs for the process over the period of data collection have been collected, and that the unit process data will comply with the cut-off rules of EN 15804. The EPD covers end-of-life in United Kingdom.

Background data are consistently sourced from the MLC (GaBi) Databases 2025.1 (Sphera, 2025).

The selection of the background data for electricity generation is in line with the BRE Global PCR PN514 3.1 for Type III EPD of Construction Products to EN 15804+A2. The electricity mix for Fushun New Steel Corporation Ltd is modelled according to the most recent data from IEA (International Energy Agency (IEA), 2025), which represents in this case the reference year 2023. Thus, production mix of Northeast China grid has been selected to suit specific manufacturing location. The emission factor of carbon footprint of the applied production mix of Northeast China grid in 0.713 kg CO_2 eq/kWh.

There wasn't any data from different LCI/LCA databases used considering that the overall consistency of the study has not been adversely affected.

Schemes applied for data quality assessment was as per EN 15804:2012+A2:2019, Annex E, Table E.1 — Data quality level and criteria of the UN Environment Global Guidance on LCA database development.

Geographical Representativeness	: Good
Technical Representativeness	: Good
Time Representativeness	: Very Good

Allocation

Steel production (modules A1-A3) is a complex process and generates many co-products including:

- Slags and sludges from the blast furnace, basic oxygen furnace and secondary steelmaking processes
- Energy rich gases from the coke ovens, blast furnace, basic oxygen furnace, secondary steelmaking processes
- Dusts and sludges from the blast furnace, basic oxygen furnace and secondary steelmaking, sintering, pelletising and lime production processes
- Coke breeze from the coke ovens
- Scrap iron and steel from the blast furnace, basic oxygen furnace, secondary steelmaking and rolling mill processes
- Mill scale from the basic oxygen furnace, secondary steelmaking and rolling mill processes

Most of these co-products are recycled within the steel mill itself and these internal loops have been included in the LCA model. The balance of inputs and outputs is not always closed and where excess material is generated no credits are modelled in module D for material leaving the system following EN 15804+A2 (section 6.3.4.2). Similarly, where recycling occurs outside the steelworks, transport to the recycler is included, but no credits are awarded for secondary material leaving the system boundary. Instead, all benefits and loads are cut off after the transport step. This cut-off approach is more conservative than EN 15804 section 6.3.5.2, which states that "Flows leaving the system at the end-of-waste boundary of the product stage (A1-A3) shall be allocated as co-products (see 6.4.3.2)."

The value of the steel product far exceeds the value of the cut off secondary material streams, meaning that co-product allocation would typically allocate a very large share (approaching 100%) to the main product and a very

low share (approaching 0%) to the co-products. As such, the difference in results between the cut-off and co-product allocation approaches will be small.

There are the following exceptions to this approach:

- Blast furnace slag (BF slag) – this is not recycled internally but is generally sold for use in concrete, road building, etc. Impacts from the steel production process are allocated to the steel and BF slag co-products based on their economic value. CARES estimates that the value of reinforcing steel products is around $670/tonne in 2023.
- Specifying a price for BF slag is very difficult as it is not traded openly. Prices agreed between steel producers and users of the slag are not made public and can vary considerably depending on quality, quantity, demand, contract period, etc. CARES estimates as per its market intelligence that the value of GGBFS products is around $60/tonne in 2023.
- Coke oven products – as well as coke and coke breeze the coking process generates tar, ammonium sulphate, sulphuric acid, benzene and polymers of benzene separation. Due to commercial sensitivity, there is no price information available on these co-products. For this reason, mass-based allocation has been applied for co-products from this process. We acknowledge that this does not fully conform to the requirements of the PCR but feel that this approach is preferable to allocating all the impacts to the coke and coke breeze when some of the co-products are likely to have relatively high values (coke and coke breeze combined account for >99% of the output of this process).
- Energy rich gases – any excess gas generated that is not used within the steelworks is combusted to generate electricity and is sold externally. In the model this is looped back to satisfy some of the electricity demand of the steelworks.
- Process gases – Oxygen, Nitrogen, Argon and other gases produced from the on-site air separation unit are all consumed on site (no exports beyond A1-A3 boundary). For the particular production route modelled, impacts are allocated to the consumed gases based on volume.
- Pre-consumer steel scrap is produced as a co-product from the steel manufacturing processes. This co-product is internally recycled.
- Post-consumer scrap is an input to steelmaking processes and is assumed to be free of burdens as once steel scrap has been collected for recycling it is considered to have reached the end of waste state. Hence, only transport impacts associated with importing the scrap are considered.

Allocation of background data (energy and materials) taken from the MLC (GaBi) Databases 2025.1 (Sphera, 2025).

All impacts associated with solid and liquid waste disposal are allocated to steel products. This includes transport and landfill or wastewater treatment processes (modules A & C).

Cut-off criteria

For the processes within the system boundary, all available energy and material flow data have been included in the model. In cases where no matching life cycle inventories are available to represent a flow, proxy data have been applied based on conservative assumptions regarding environmental impacts. Burdens relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary. As no material or energy flows were knowingly omitted, the requirements of the PCR have been met (BRE Global PCR PN514 3.1).

The mass of steel wire or strap that can be used for binding the carbon steel billet products is less than 1 % of the total mass of the product.

LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Core environmental impact indicators									
Life Cycle Stage	Impact Category		GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg P eq
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	2.35E+03	2.35E+03	3.84E+00	6.78E-01	6.37E-09	1.15E+00	8.57E-04
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND	ND
%95 Recycling / %5 Landfill Scenario									
End of life	Deconstruction, demolition	C1	2.09E+00	2.09E+00	8.33E-04	6.83E-05	1.62E-13	1.15E-02	2.52E-07
	Transport	C2	2.38E-01	2.22E-01	1.61E-02	1.21E-05	2.58E-14	2.64E-04	2.86E-08
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	7.70E-01	7.64E-01	2.68E-03	3.13E-03	2.13E-12	5.40E-03	1.14E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.03E+03	-2.03E+03	-8.81E-01	-1.03E+00	-8.50E-09	-6.64E+00	-1.79E-03
100% Landfill Scenario									
End of life	Deconstruction, demolition	C1	2.09E+00	2.09E+00	8.33E-04	6.83E-05	1.62E-13	1.15E-02	2.52E-07
	Transport	C2	4.75E+00	4.43E+00	3.22E-01	2.43E-04	5.16E-13	5.28E-03	5.73E-07
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.54E+01	1.53E+01	5.36E-02	6.27E-02	4.25E-11	1.08E-01	2.27E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.82E+01	-8.84E+01	1.74E-01	-4.63E-02	-3.82E-10	-2.93E-01	-8.00E-05
100% Recycling Scenario									
End of life	Deconstruction, demolition	C1	2.09E+00	2.09E+00	8.33E-04	6.83E-05	1.62E-13	1.15E-02	2.52E-07
	Transport	C2	0	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.14E+03	-2.13E+03	-9.36E-01	-1.08E+00	-8.93E-09	-6.97E+00	-1.88E-03

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
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; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Core environmental impact indicators

Life Cycle Stage	Impact Category		EP-marine	EP-terrestrial	POCP	ADP-mineral & metals	ADP-fossil	WDP
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	4.61E-01	5.05E+00	1.31E+00	5.28E-05	1.63E+04	6.23E+01
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
%95 Recycling / %5 Landfill Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	4.47E-02	1.14E-02	2.94E-08	2.77E+01	1.63E-02
	Transport	C2	1.01E-04	1.14E-03	2.75E-04	3.43E-09	3.17E+00	9.27E-04
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.41E-03	1.54E-02	4.23E-03	4.73E-08	1.00E+01	8.26E-02
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.48E+00	-1.44E+01	-4.93E+00	-5.09E-05	-1.68E+04	7.53E+01
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	4.47E-02	1.14E-02	2.94E-08	2.77E+01	1.63E-02
	Transport	C2	2.01E-03	2.28E-02	5.50E-03	6.86E-08	6.34E+01	1.85E-02
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	2.83E-02	3.08E-01	8.46E-02	9.46E-07	2.00E+02	1.65E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-6.48E-02	-6.27E-01	-2.17E-01	-2.24E-06	-7.13E+02	3.40E+00
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	4.47E-02	1.14E-02	2.94E-08	2.77E+01	1.63E-02
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.55E+00	-1.51E+01	-5.18E+00	-5.35E-05	-1.77E+04	7.91E+01

ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption.
The results of the three environmental impact indicators above shall be used with care as the uncertainties on these results are high or as there is limited experienced with these indicators.

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

Life Cycle Stage	Impact Category		PM	IRP	ETP-fw	HTP-c	HTP-nc	SQP
			disease incidence	kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	1.76E-05	8.55E+00	2.30E+03	4.01E-08	2.70E-06	6.03E+02
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
%95 Recycling / %5 Landfill Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	3.29E+01	5.92E-10	7.53E-09	3.56E-02
	Transport	C2	2.92E-09	8.58E-05	3.76E+00	5.65E-11	8.50E-10	6.12E-03
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	6.73E-08	1.18E-02	8.64E+00	1.33E-10	4.99E-09	2.47E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-9.22E-05	5.04E+00	-2.69E+03	-3.35E-06	-6.14E-07	-6.25E+02
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	3.29E+01	5.92E-10	7.53E-09	3.56E-02
	Transport	C2	5.84E-08	1.72E-03	7.51E+01	1.13E-09	1.70E-08	1.22E-01
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.35E-06	2.35E-01	1.73E+02	2.67E-09	9.98E-08	4.95E+01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.08E-06	2.28E-01	-7.02E+01	-1.50E-07	-1.61E-08	-2.80E+01
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	3.29E+01	5.92E-10	7.53E-09	3.56E-02
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-9.69E-05	5.30E+00	-2.83E+03	-3.52E-06	-6.45E-07	-6.57E+02

IRP = Potential human exposure efficiency relative to U235; This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

HTP-nc = Potential comparative toxic unit for humans; and
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
SQP = Potential soil quality index.
The results of the four environmental impact indicators above shall be used with care as the uncertainties on these results are high or as there is limited experienced with these indicators.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use

Life Cycle Stage	Impact Category		PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	2.51E+01	0	2.51E+01	1.63E+04	0	1.63E+04
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
%95 Recycling / %5 Landfill Scenario								
End of life	Deconstruction, demolition	C1	5.59E-02	0	5.59E-02	2.77E+01	0	2.77E+01
	Transport	C2	1.59E-02	0	1.59E-02	3.17E+00	0	3.17E+00
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.93E+00	0	1.93E+00	1.00E+01	0	1.00E+01
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	6.99E+02	0	6.99E+02	-1.68E+04	0	-1.68E+04
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	5.59E-02	0	5.59E-02	2.77E+01	0	2.77E+01
	Transport	C2	3.17E-01	0	3.17E-01	6.34E+01	0	6.34E+01
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	3.87E+01	0	3.87E+01	2.00E+02	0	2.00E+02
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	3.17E+01	0	3.17E+01	-7.13E+02	0	-7.13E+02
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	5.59E-02	0	5.59E-02	2.77E+01	0	2.77E+01
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	7.34E+02	0	7.34E+02	-1.77E+04	0	-1.77E+04

PERE = Use of renewable primary energy excluding renewable primary energy 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 resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use						
Life Cycle Stage	Impact Category		SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	7.18E+01	0	0	2.45E+00
Construction process stage	Transport	A4	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND
%95 Recycling / %5 Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	2.44E-05
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	2.42E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	9.67E-01
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	4.88E-04
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	4.84E-02
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	4.38E-02
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	0
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	1.02E+00

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
Life Cycle Stage	Impact Category		HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG
	Total (of product stage)	A1-3	-1.28E-06	9.46E+01	5.42E-02
Construction process stage	Transport	A4	ND	ND	ND
	Construction	A5	ND	ND	ND
Use stage	Use	B1	ND	ND	ND
	Maintenance	B2	ND	ND	ND
	Repair	B3	ND	ND	ND
	Replacement	B4	ND	ND	ND
	Refurbishment	B5	ND	ND	ND
	Operational energy use	B6	ND	ND	ND
	Operational water use	B7	ND	ND	ND
%95 Recycling / %5 Landfill Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	4.11E-03	7.85E-06
	Transport	C2	6.51E-11	1.08E-04	1.24E-06
	Waste processing	C3	0	0	0
	Disposal	C4	2.19E-09	5.00E+01	1.06E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.57E-06	-2.08E+01	8.23E-02
100% Landfill Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	4.11E-03	7.85E-06
	Transport	C2	1.30E-09	2.16E-03	2.49E-05
	Waste processing	C3	0	0	0
	Disposal	C4	4.38E-08	1.00E+03	2.12E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.16E-07	-9.34E-01	3.72E-03
100% Recycling Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	4.11E-03	7.85E-06
	Transport	C2	0	0	0
	Waste processing	C3	0	0	0
	Disposal	C4	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.69E-06	-2.18E+01	8.64E-02

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
Life Cycle Stage	Impact Category		CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	0	0	0	0	0	0
Construction process stage	Transport	A4	ND	ND	ND	ND	ND	ND
	Construction	A5	ND	ND	ND	ND	ND	ND
Use stage	Use	B1	ND	ND	ND	ND	ND	ND
	Maintenance	B2	ND	ND	ND	ND	ND	ND
	Repair	B3	ND	ND	ND	ND	ND	ND
	Replacement	B4	ND	ND	ND	ND	ND	ND
	Refurbishment	B5	ND	ND	ND	ND	ND	ND
	Operational energy use	B6	ND	ND	ND	ND	ND	ND
	Operational water use	B7	ND	ND	ND	ND	ND	ND
%95 Recycling / %5 Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	9.50E+02	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0	0	0
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0	0	0
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	0	0	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	0	1.00E+03	0	0	0	0
	Disposal	C4	0	0	0	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	0	0	0

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
Modules C1 to C4 End of life	The end-of-life stage starts when the construction product is replaced, dismantled or deconstructed from the building or construction works and does not provide any further function. The recovered steel is transported for recycling while a small portion is assumed to be unrecoverable and remains in the rubble which is sent to landfill. 95% of the reinforcing steel is assumed to be recycled and 5% is sent to landfill [STEELCONSTRUCTION.INFO 2012]. Once steel scrap is generated through the deconstruction activities on the demolition site it is considered to have reached the "end of waste" state. No further processing is required so there are no impacts associated with this module. Hence no impacts are reported in module C3.		
	Waste for recycling - Recovered steel from crushed concrete	%	95
	Waste for energy recovery	%	-
	Waste for final disposal - Unrecoverable steel lost in crushed concrete and sent to landfill	%	5
	Portion of energy assigned to rebar from energy required to demolish building, per tonne	MJ	24
	Transport to waste processing by Truck - Fuel consumption	litre/km	1.56
	Transport to waste processing by Truck – Distance	km	463
	Transport to waste processing by Truck – Capacity utilisation	%	85
	Transport to waste processing by Truck – Density of Product	kg/m^3	7850
	Transport to waste processing by Container ship - Fuel consumption	litre/km	0.0041
	Transport to waste processing by Container ship - Distance	km	158
	Transport to waste processing by Container ship – Capacity utilisation	%	50
	Transport to waste processing by Container ship – Density of Product	kg/m^3	7850
Module D	It is assumed that 95% of the steel used in the structure is recovered for recycling, while the remainder is landfilled. Module D accounts for the environmental benefits and loads resulting from net steel scrap that is used for recycling at end of life. The balance between total scrap arisings recycled from installation and end of life and scrap consumed by the manufacturing process (internally sourced scrap is not included in this calculation). These benefits and loads are calculated by including the burdens of recycling and the benefit of avoided primary production. A large amount of net scrap is generated over the life cycle as the BF/BOF production route is primarily from virgin sources and there is a very high end of life recycling rate for this product. Benefits and loads associated with this scrap are calculated by including the burdens of recycling process and accounting for the avoided primary production. As a result, module D reports the credits associated with the scrap output. The resulting scrap credit/burden is calculated based on the global "value of scrap" approach (/worldsteel 2011).		
	Recycled Content	kg	62
	Re-used Content	kg	0
	Recovered for recycling	kg	920
	Recovered for re-use	kg	0
	Recovered for energy	kg	0

Summary, comments and additional information

Interpretation

The production stage (A1-A3) is the most important module for climate change, eutrophication freshwater, resource use (mineral and metals) and resource use (energy carriers) as well as water scarcity

Module D presents a significant credit in all impact categories, except for ODP. Impacts from other life cycle stages are negligible in comparison

References

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A2:2019. London, BSI, 2019.

BSI. Environmental labels and declarations. Self-declared environmental claims (Type II environmental labelling). BS EN ISO 14021:2016+A1:2021. London, BSI, 2022

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (exactly identical to ISO 14025:2006). London, BSI, 2010.

BSI. Environmental management – Life cycle assessment – Principles and framework. BS EN ISO BS EN ISO 14040:2006+A1:2020. London, BSI, 2020.

BSI. Environmental management – Life cycle assessment – requirements and guidelines. BS EN ISO 14044:2006+A2:2020. London, BSI, 2020.

BSI. Sustainability of construction works. Data quality for environmental assessment of products and construction work. Selection and use of data. BS EN 15941:2024. London, 2024.

BSI. Sustainability of construction works. Environmental product declarations. Communication format business-to-business. BS EN 15942:2021. London, 2021.

BSI. Eurocode. Basis of structural and geotechnical design. BS EN 1990:2023. London, 2023.

Demolition Energy Analysis of Office Building Structural Systems, Athena Sustainable Materials Institute, 1997

The Concrete Society, Design working life (concrete.org.uk)

LCA FE (GaBi) Software System and Database for Life Cycle Engineering, Sphera Solution GmbH, Leinfelden-Echterdingen

Sphera. (2025). Sphera MLC Database Documentation. Retrieved from Sphera: https://lcadatabase.sphera.com/

International Energy Agency (IEA). (2025, 04 08). Energy system of China - 2023. Retrieved from https://www.iea.org/countries/china

Kreißig, J. und J. Kümmel (1999): Baustoff-Ökobilanzen. Wirkungsabschätzung und Auswertung in der Steine-Erden-Industrie. Hrsg. Bundesverband Baustoffe Steine + Erden e.V.

U.S. Geological Survey, Mineral Commodity Summaries, Iron and Steel Slag, January 2014

U.S. Geological Survey. (2017). Mineral Commodity Summaries 2017. U.S. Department of the Interior

Sanson, M. a. (2014). Reuse and recycling rates of UK steel demolition arisings. Proceedings of the Institution of Civil Engineers - Engineering Sustainability.

SteelConstruction.info; The recycling and reuse survey, 2012
http://www.steelconstruction.info/The_recycling_and_reuse_survey

Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data; German version CEN/TR 15941

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

WRAP (2017). WRAP (Waste & Resources Action Programme) Net Waste Tool

worldsteel Association - Life cycle inventory methodology report for steel products, 2017

CARES SRC Steel for the reinforcement of concrete scheme Appendix 5 - Quality and operations assessment schedule for the production of billets and wire rod for further processing into carbon steel bar, coil or rod for the reinforcement of concrete, including inspection and testing requirements.

GB 1499.2-2024 Steel for the reinforcement of concrete-Part 2: Hot rolled ribbed bars

BS 4449:2005+A3:2016 Steel for the reinforcement of concrete. Weldable reinforcing steel. Bar, coil and decoiled product. Specification.

SS 560:2016 - Specification for steel for the reinforcement of concrete – Weldable reinforcing steel – Bar, coil and decoiled product.

CS2:2012 - Steel Reinforcing Bars for the Reinforcement of Concrete

KS D 3504:2021 - Steel Bars for the Concrete Reinforcement

ASTM A615/A615M – 24 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

ASTM A706/A706M – 24 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

SASO ASTM A615/A615M+A1:2023 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

SASO-ASTM-A706M:2022 Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

ISO 6935-2:2019 - Steel for the reinforcement of concrete - Part 2: Ribbed bars.

NTC 22890:2020 Low-alloy steel deformed and plain bars for concrete reinforcement

GOST 5781-1982 Hot-rolled steel for reinforcement of ferroconcrete structures. Specifications

EN 10080:2005 Steel for the reinforcement of concrete. Weldable reinforcing steel. General