Environmental Product Declaration

Statement of Verification

CARES EPD No.: 0030

Issue 01

This is to verify that the

Environmental Product Declaration

Provided by:

Jiangyin Fasten Steel Products Co. Ltd

Is in accordance with the requirements of:

ISO 14025:2010 and EN 15804:2012 + A2:2019/AC2021

and BRE Global PCR for Type III EPD of Construction Products to EN 15804+A2. PN514 3.1

This declaration is for: High tensile steel strand products for the prestressing of concrete manufactured by the secondary (scrap-based) production route

Company address:

No. 3456 Zhencheng Road,
Jiangyin
Jiangsu
China

	Ladin Camci	09 July 2025
Signed for CARES	Operator	Date of this Issue
09 July 2025		08 July 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 0030

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 version 2.8 SPHERA SOLUTIONS UK LIMITED The Innovation Centre Warwick Technology Park, Gallows Hill, Warwick, Warwickshire CV34 6UW UK www.sphera.com
Declared/Functional Unit	1 tonne of high tensile steel strand products for the prestressing of concrete manufactured by the secondary (scrap-based) 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	LCA FE (GaBi) Dataset Documentation (Sphera 2023.1)

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/AC2021. 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/AC2021 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
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: Checks indicate the Information Modules declared.

Manufacturing site

Jiangyin Fasten Steel Products Co. Ltd
No. 3456 Zhencheng Road
Jiangyin
Jiangsu
China

Construction Product:

Product Description

High tensile prestressed steel strand for prestressed concrete is obtained by winding multiple wires to form the strand in various sizes (according to the product standards listed in the references section of this EPD). Wires used for the manufacturing of the strand are obtained by cold drawing of high carbon steel feedstock coils produced by hot rolling of continuously cast steel billets obtained from the secondary (scrap-based) production route. High tensile prestressed steel strand for prestressed concrete is used to provide tensile strength in reinforced concrete structural elements.

The declared unit is 1 tonne of high tensile steel wire products for the prestressing of concrete manufactured by the secondary (scrap-based) production route.

This EPD covers high tensile strength prestressing steel strand for prestressed concrete products manufactured by Jiangyin Fasten Steel Products Co. Ltd from high carbon steel feedstock coils purchased from manufacturers using the secondary (scrap-based) production route.

This product is traceable with CARES Post Tensioning Systems for Concrete Structures Scheme's traceability systems (https://www.carescertification.com/certification-schemes/post-tensioning-systems) and CARES Cloud digital platform (https://cares.cloud/) with the designation of coil numbers ending with E (e.g. FB2500965-E).

Technical Information

Property	Value, Unit
Production route	Scrap - EAF
Density	7810 kg/m^3
Modulus of elasticity	195 GPa
Characteristic Value of 0.1% Proof Force Fp0.1 (as per BS 5896:2012; value depending on steel name and diameter of wire)	62.2 to 334 kN
Nominal Tensile strength (as per BS 5896:2012; value depending on steel name and diameter of wire)	1670 to 1860 MPa
Characteristic Value of Maximum Force Fm	92 to 379 kN
Agt (total minimum % elongation at maximum force as per BS 5896:2012) (with Lo ≥ 100mm for Wire; Lo ≥ 500mm for Strand)	min 3.5%
Maximum relaxation at 1000 h for initial force corresponding to 70% (as per BS 5896:2012)	min 2.5%
Recycled content (as per ISO 14021:2016/Amd:2021) (weighted average of supplier's recycled content)	81.7 (Including internal and external scrap) 81.2 (Including external scrap only)

Main Product Contents

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

Manufacturing Process

Steel scrap (a limited amount of DRI can also be added) is melted in an EAF (Electric Arc Furnace) to obtain liquid metal. This is then refined through secondary metallurgy processes to remove impurities and make alloying additions to give the steel the required properties.

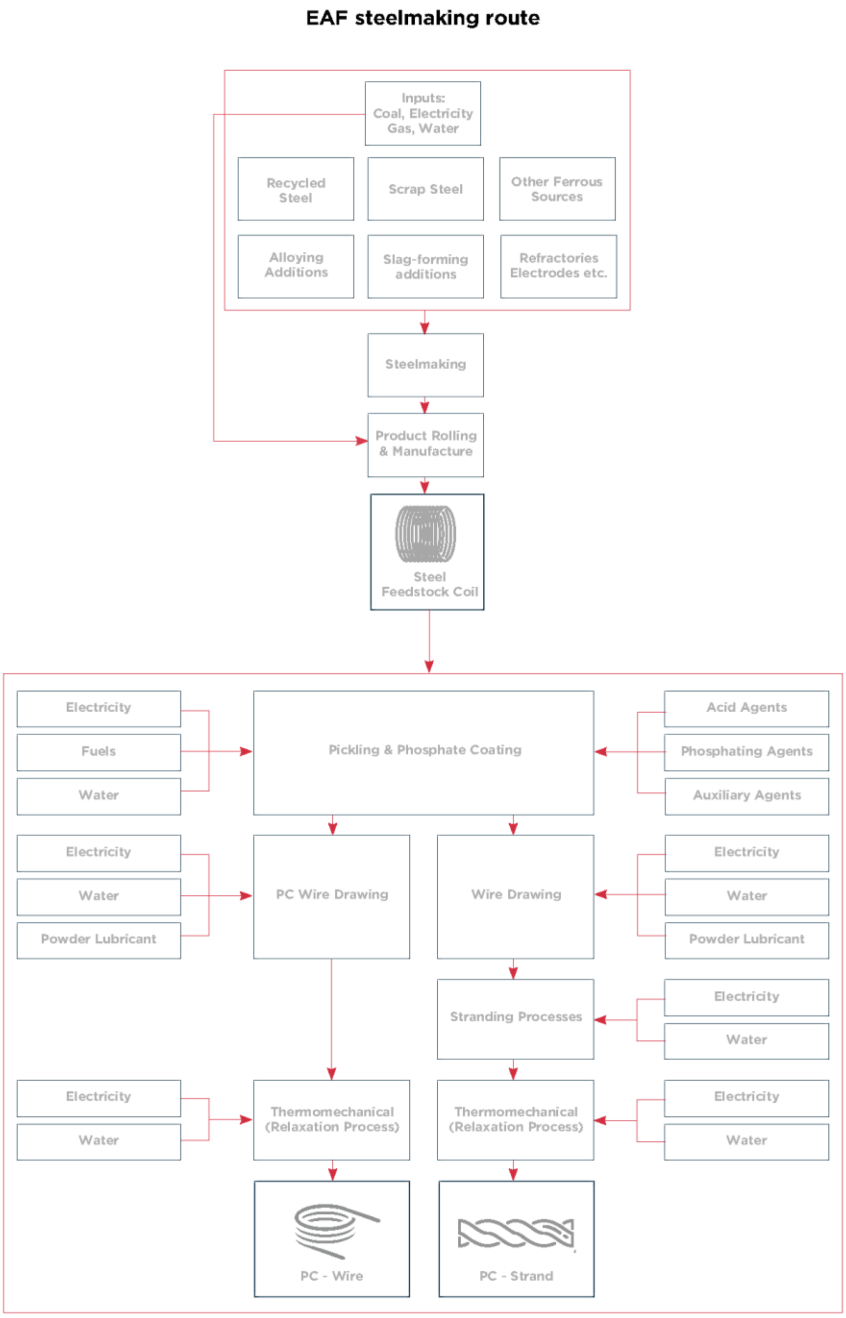
Refined liquid steel is then cast into steel billets before being sent to the rolling mill where they are rolled to the required dimensions for the finished coils of the high carbon steel wire rods.

High carbon steel wire rods are cold drawn into required dimensions for the semi-finished wires, which are then twined to form steel strand for the prestressing of concrete in various sizes (according to the product standards listed in the references section of this EPD).

The products are packaged by binding with steel straps; both the steel ties and products do not include any biogenic materials.

Wrapping paper and wooden wedge that contain biogenic material are used for the packaging and handling of the final products. Their total mass is 0.24% of the total mass of the product but less than 1%, thus their biogenic carbon is not considered in this declaration.

Process flow diagram



Construction Installation

Processing and proper use of high tensile steel strand products depends on the application and should be made in accordance with generally accepted practices, standards and manufacturing recommendations.

During transport and storage of high tensile steel strand products the usual requirement for the special care for securing loads is to be observed.

Use Information

The composition of the high tensile steel strand products does not change during use.

High tensile steel strand 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 high tensile steel strand products itself.

End of Life

High tensile steel strand products 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 92% is typical for high tensile steel strand products.

Life Cycle Assessment Calculation Rules

This EPD uses the "Cut-off by Classification" method, also known as the recycled content method. It assigns the environmental impacts of primary material production to the initial user. Recyclable materials enter the recycling process without burdens, and secondary materials only bear the impacts of recycling.

This method promotes recycling by making producers responsible for waste management. It supports a circular economy by reducing the environmental impacts of primary material production.

This approach follows ISO 14040 and ISO 14044 standards for Life Cycle Assessments.

The Life Cycle Impact Assessment (LCIA) has been carried out using the characterisation method described in EN 15804+A2. The characterisation factors from Environmental Footprint v3.0 (EF 3.0) was applied.

Declared unit description

1 tonne of high tensile steel strand products for the prestressing of concrete manufactured by the secondary (scrap-based) 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.

Data sources, quality and allocation

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.

Data Sources: Manufacturing data of the high tensile steel strand products for the prestressing of concrete covering the period 01/01/2024 - 31/12/2024 has been provided by Jiangyin Fasten Steel Products Co. Ltd operating on the geographical area noted in Manufacturing Site. High carbon steel wire rods used in the production of high tensile steel strand products for the prestressing of concrete production were purchased only from external suppliers which are using the secondary production route (scrap based). For these, generic data was used.

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 by CARES, 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 transport to, and end-of-life in China.

The selection of the background data for electricity generation is in line with the BRE Global PCR PN514 3.1. Country or region-specific power grid mixes are selected from LCA FE (GaBi) Dataset Documentation (Sphera 2023.1); thus, consumption grid mix of China - East has been selected to suit specific manufacturing location, and also for fabrication, installation and demolishing location. The emission factor of carbon footprint of the applied consumption grid mix of China - East in 0.7325 kg CO_2 eq/kWh.

Data Quality: Background data is consistently sourced from the LCA FE (GaBi) Dataset Documentation (Sphera 2023.1). The primary data collection was thorough, considering all relevant flows and these data have been verified during the audit conducted by CARES in April 2025.

There isn't any data from different LCI/LCA databases are used considering that the overall consistency of the study is not 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. No fair, poor or very poor data was found during the assessment of relevant data.

Data quality level and criteria of the UN Environment Global Guidance on LCA database development:

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

Allocation:

Mill scale is produced as co-products from the high strength steel wire and strand manufacturing process. Impacts are allocated between the steel, the slag and the mill scale based on economic value. The revenue generated from mill scale is 0.13%, which is less than 1% in relation to the product based on current market prices, these co-products are of definite value and are freely/readily traded in reality. For this reason, economic allocation has been applied to the processes where these co-products arise.

Production losses of steel during the production process are recycled in a closed loop offsetting the requirement for external scrap. Specific information on allocation within the background data is given in the LCA FE (GaBi) Dataset Documentation (Sphera 2023.1).

Cut-off criteria

On the input side all flows entering the system and comprising more than 1% in total mass or contributing more than 1% to primary energy consumption are considered. All inputs used as well as all process-specific waste and process emissions were assessed. For this reason, material streams which were below 1% (by mass) were captured as well. In this manner the cut-off criteria according to the PCR requirements are fulfilled).

The mass of steel wire or strap used for binding the product bundle is less than 1 % of the total mass of the product.

LCA Results

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

Core environmental impact indicators									
Life Cycle Stage	Impact Category		GWP-total kg CO_2 eq	GWP-fossil kg CO_2 eq	GWP-biogenic kg CO_2 eq	GWP-luluc kg CO_2 eq	ODP kg CFC11 eq	AP mol H^+ eq	EP-freshwater Kg P eq
Product stage	Raw material supply	A1	798	797	0.246	0.291	8.17E-07	7.24	5.09E-04
	Transport	A2	4.20	4.22	-0.059	0.039	3.64E-13	0.013	1.52E-05
	Manufacturing	A3	223	223	-0.079	0.141	3.91E-09	0.762	1.36E-04
	Total (of product stage)	A1-3	1.03E+03	1.02E+03	0.108	0.471	8.21E-07	8.01	6.60E-04
Construction process stage	Transport	A4	20.7	20.8	-0.290	0.190	1.8E-12	0.064	7.48E-05
	Construction	A5	21.5	21.6	-0.090	0.018	1.64E-08	0.166	1.72E-05
Use stage	Use	B1	0	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0	0
%92 Recycling / %8 Landfill Scenario									
End of life	Deconstruction, demolition	C1	2.15	2.15	2.65E-03	4.06E-05	1.64E-13	0.003	4.12E-07
	Transport	C2	47.1	47.3	-0.617	0.407	4.04E-12	0.235	1.61E-04
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.17	1.20	-0.040	0.004	3.05E-12	0.009	2.42E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	367	368	-0.543	0.007	-1.27E-09	0.577	-6.15E-05
100% Landfill Scenario									
End of life	Deconstruction, demolition	C1	2.15	2.15	2.65E-03	4.06E-05	1.64E-13	0.003	4.12E-07
	Transport	C2	2.17	2.18	-0.030	0.020	1.88E-13	0.009	7.83E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	14.6	15.0	-0.499	0.047	3.82E-11	0.107	3.02E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	2.25E+03	2.25E+03	-4.23	0.788	-6.80E-09	4.82	7.79E-05
100% Recycling Scenario									
End of life	Deconstruction, demolition	C1	2.15	2.15	2.65E-03	4.06E-05	1.64E-13	0.003	4.12E-07
	Transport	C2	51	51.2	-0.668	0.440	4.37E-12	0.255	1.74E-04
	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	203	204	-0.223	-0.061	-7.89E-10	0.208	-7.37E-05

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)

(ND = 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	m³ world eq deprived
Product stage	Raw material supply	A1	0.006	11.6	3.20	5.80E-05	9.35E+03	0.232
	Transport	A2	0.006	0.066	0.012	2.68E-07	56.5	0.048
	Manufacturing	A3	0.167	1.81	0.493	2.08E-05	2.41E+03	38.3
	Total (of product stage)	A1-3	0.179	13.5	3.70	7.91E-05	1.18E+04	38.6
Construction process stage	Transport	A4	0.029	0.328	0.058	1.32E-06	279	0.237
	Construction	A5	0.035	0.298	0.079	1.65E-06	252	0.805
Use stage	Use	B1	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0
%92 Recycling / %8 Landfill Scenario								
End of life	Deconstruction, demolition	C1	1.16E-03	0.013	0.004	2.15E-08	28.4	0.005
	Transport	C2	0.113	1.26	0.235	2.86E-06	633	0.511
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.002	0.024	0.007	5.54E-08	16.0	0.132
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.177	1.91	0.605	-9.09E-05	2.41E+03	-20.3
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	1.16E-03	0.013	0.004	2.15E-08	28.4	0.005
	Transport	C2	0.004	0.048	0.008	1.38E-07	29.2	0.025
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.028	0.303	0.083	6.92E-07	200	1.65
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.20	12.9	4.00	-7.14E-05	1.63E+04	6.49
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	1.16E-03	0.013	0.004	2.15E-08	28.4	0.005
	Transport	C2	0.122	1.36	0.255	3.10E-06	685	0.553
	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	0.088	0.954	0.310	-9.26E-05	1.19E+03	-22.6

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)

(ND = 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	8.47E-05	20.9	5.09E-04	1.78E-07	6.69E-06	897
	Transport	A2	7.65E-08	0.011	1.52E-05	8.02E-10	5.00E-08	23.6
	Manufacturing	A3	1.04E-05	4.37	1.36E-04	4.30E-08	1.53E-06	300
	Total (of product stage)	A1-3	9.52E-05	25.3	6.60E-04	2.22E-07	8.27E-06	1.22E+03
Construction process stage	Transport	A4	3.78E-07	0.052	7.48E-05	3.96E-09	2.47E-07	116
	Construction	A5	1.95E-06	0.521	1.72E-05	4.75E-09	1.91E-07	34.4
Use stage	Use	B1	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0
%92 Recycling / %8 Landfill Scenario								
End of life	Deconstruction, demolition	C1	1.88E-08	4.64E-03	4.12E-07	4.86E-10	1.52E-08	0.095
	Transport	C2	1.73E-06	0.117	1.61E-04	8.94E-09	5.50E-07	249
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.05E-07	0.021	2.42E-06	1.34E-09	1.48E-07	3.89
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	5.63E-06	-6.84	-6.15E-05	-3.03E-07	2.09E-06	-410
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	1.88E-08	4.64E-03	4.12E-07	4.86E-10	1.52E-08	0.095
	Transport	C2	4.68E-08	0.005	7.83E-06	4.14E-10	2.59E-08	12.2
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.31E-06	0.263	3.02E-05	1.68E-08	1.85E-06	48.6
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	6.76E-05	-34.2	7.79E-05	2.60E-06	1.33E-05	-1.72E+03
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	1.88E-08	4.64E-03	4.12E-07	4.86E-10	1.52E-08	0.095
	Transport	C2	1.88E-06	0.127	1.74E-04	9.68E-09	5.96E-07	270
	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	2.41E-07	-4.46	-7.37E-05	-5.56E-07	1.11E-06	-296

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)

(ND = 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	1.77E+03	0	1.77E+03	9.35E+03	0	9.35E+03
	Transport	A2	4.00	0	4.00	56.7	0	56.7
	Manufacturing	A3	1.09E+03	0	1.09E+03	2.41E+03	0	2.41E+03
	Total (of product stage)	A1-3	2.86E+03	0	2.86E+03	1.18E+04	0	1.18E+04
Construction process stage	Transport	A4	19.7	0	19.7	280	0	280
	Construction	A5	59.8	0	59.8	252	0	252
Use stage	Use	B1	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0
%92 Recycling / %8 Landfill Scenario								
End of life	Deconstruction, demolition	C1	0.125	0	0.125	28.4	0	28.4
	Transport	C2	42.4	0	42.4	634	0	634
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	2.61	0	2.61	16.0	0	16.0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-681	0	-681	2.44E+03	0	2.44E+03
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	0.125	0	0.125	28.4	0	28.4
	Transport	C2	2.07	0	2.07	29.3	0	29.3
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	32.6	0	32.6	200	0	200
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.00E+03	0	-3.00E+03	1.65E+04	0	1.65E+04
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	0.125	0	0.125	28.4	0	28.4
	Transport	C2	45.9	0	45.9	687	0	687
	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	-480	0	-480	1.22E+03	0	1.22E+03

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)

(ND = 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	m³
Product stage	Raw material supply	A1	0	0	0	0.232
	Transport	A2	0	0	0	0.048
	Manufacturing	A3	1.14E+03	0	0	38.3
	Total (of product stage)	A1-3	1.14E+03	0	0	38.6
Construction process stage	Transport	A4	0	0	0	0.237
	Construction	A5	0	0	0	0.805
Use stage	Use	B1	0	0	0	0
	Maintenance	B2	0	0	0	0
	Repair	B3	0	0	0	0
	Replacement	B4	0	0	0	0
	Refurbishment	B5	0	0	0	0
	Operational energy use	B6	0	0	0	0
	Operational water use	B7	0	0	0	0
%92 Recycling / %8 Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0.005
	Transport	C2	0	0	0	0.511
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.132
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-223	0	0	-20.3
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0.005
	Transport	C2	0	0	0	0.025
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	1.65
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.14E+03	0	0	6.49
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0.005
	Transport	C2	0	0	0	0.553
	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	-143	0	0	-22.6

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)

(ND = 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	1.09E-06	77.9	0.135
	Transport	A2	2.10E-10	0.008	7.33E-05
	Manufacturing	A3	1.33E-07	1.62	0.070
	Total (of product stage)	A1-3	1.22E-06	79.5	0.205
Construction process stage	Transport	A4	1.04E-09	0.040	3.62E-04
	Construction	A5	2.91E-08	3.20	0.004
Use stage	Use	B1	0	0	0
	Maintenance	B2	0	0	0
	Repair	B3	0	0	0
	Replacement	B4	0	0	0
	Refurbishment	B5	0	0	0
	Operational energy use	B6	0	0	0
	Operational water use	B7	0	0	0
%92 Recycling / %8 Landfill Scenario					
End of life	Deconstruction, demolition	C1	8.19E-11	0.006	3.28E-05
	Transport	C2	2.30E-09	0.090	8.15E-04
	Waste processing	C3	0	0	0
	Disposal	C4	3.49E-10	80.1	1.82E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-0.007	7.13	-0.062
100% Landfill Scenario					
End of life	Deconstruction, demolition	C1	8.19E-11	0.006	3.28E-05
	Transport	C2	1.08E-10	0.004	3.78E-05
	Waste processing	C3	0	0	0
	Disposal	C4	4.36E-09	1.00E+03	0.002
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-7.27E-03	35.1	-0.309
100% Recycling Scenario					
End of life	Deconstruction, demolition	C1	8.19E-11	0.006	3.28E-05
	Transport	C2	2.49E-09	0.097	8.82E-04
	Waste processing	C3	0	0	0
	Disposal	C4	0	0	0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-7.28E-03	4.70	-0.041

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

LCA Results (continued)

(ND = 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	0	0	0	0	0	0
	Transport	A2	0	0	0	0	0	0
	Manufacturing	A3	0	0	0	0	0	0
	Total (of product stage)	A1-3	0	0	0	0	0	0
Construction process stage	Transport	A4	0	0	0	0	0	0
	Construction	A5	0	0	0	0	0	0
Use stage	Use	B1	0	0	0	0	0	0
	Maintenance	B2	0	0	0	0	0	0
	Repair	B3	0	0	0	0	0	0
	Replacement	B4	0	0	0	0	0	0
	Refurbishment	B5	0	0	0	0	0	0
	Operational energy use	B6	0	0	0	0	0	0
	Operational water use	B7	0	0	0	0	0	0
%92 Recycling / %8 Landfill Scenario								
End of life	Deconstruction, demolition	C1	0	920	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	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% 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
	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	1.00E+03	0	0	0	0
	Transport	C2	0	0	0	0	0	0
	Waste processing	C3	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

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
Module A4 Transport to the Building Site	On leaving the manufacturing factory the high-tensile prestressed steel strand products are transported to the construction site, including provision of all materials and products. Road transport distance to site is assumed to be 350 km. Only the one-way distance is considered as it is assumed that the logistics companies will optimise their distribution and not return empty in modules beyond A3.		
	Truck trailer - Fuel	litre/km	1.56
	Distance	km	350
	Capacity utilisation (including empty returns)	%	85
	Bulk density of transported products	kg/m³	7850
Module A5 Installation in the Building	Installation in the building; including provision of all materials, products, and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the construction stage. Installation of the product into the building is assumed to result in 10% wastage (determined based on typical installation losses reported by the WRAP Net Waste Tool [WRAP 2017]). It is assumed that fabrication requires 15.34 kWh/tonne finished product, and that there is a 2% wastage associated with this process.		
	Ancillary materials for installation - Waste material from fabrication, losses per tonne of construction steel forms	%	2
	Energy Use - Energy per tonne required to fabricate construction steel forms	kWh	15.34
	Waste materials from installation wastage	%	10
Module B2 Maintenance	No maintenance required.		
Module B3 Repair	No repair process required.		
Module B4 Replacement	No replacement considerations required.		
Module B5 Refurbishment	No refurbishment process required.		
Reference Service Life	High-tensile prestressed steel strand products for the prestressing of concrete are used in the main building structure so the reference service life will equal the lifetime of the building. BS EN 1990 specifies "building structures and other common structures" as having a lifetime of 50 years. On this basis, the RSL for this EPD is assumed to be 50 years.		
Module B6 Use of Energy	No energy required during use stage related to the operation of the building.		
Module B7 Use of Water	No water required during use stage related to the operation of the building.		
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. 92% of the high-tensile prestressed steel strand is assumed to be recycled and 8% is sent to landfill [STEELCONSTRUCTION.INFO 2012]. The EPD covers transport to, and end-of-life in China. 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	%	92
	Waste for energy recovery - Energy recovery is not considered for this study as most end-of-life steel scrap is recycled, while the remainder is landfilled	-	-
	Waste for final disposal - Unrecoverable steel lost in crushed concrete and sent to landfill	%	8
	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/m³	7810
	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/m³	7810

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
Module D	It is assumed that 92% of the steel used in the structure is recovered for recycling, while the remainder is landfilled. "Benefits and loads beyond the system boundary" (module D) accounts for the environmental benefits and loads resulting from net steel scrap that is used as raw material in the EAF and that is collected for recycling at end of life. The balance between total scrap arisings recycled from fabrication, 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. This study is concerned with billets manufactured from secondary production route in which steel scrap is the main ferrous charge to the EAF or IF, and a limited amount of DRI can also be used. In secondary production route using steel scrap only, more scrap is required as input to the system than is recovered at end of life. In DRI production route, a large amount of net scrap is generated over the life cycle as the iron ore used to obtain DRI is a virgin source and there is a high end of life recycling rate for reinforcing steel products. As majority of the raw material is the steel scrap, the net effect is that module D mainly models the burdens associated with the scrap input (secondary material) to the steelmaking process. The resulting scrap credit/burden is calculated based on the global "value of scrap" approach (/worldsteel 2011).		
	Recycled Content	kg	812
	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

Scrap based high tensile steel strand products for the prestressing of concrete of Jiangyin Fasten Steel Products Co. Ltd is made via the Electric Arc Furnace production route. The bulk of the environmental impacts and primary energy demand is attributed to the manufacturing phase, covered by information modules A1-A3 of EN 15804+A2.

The interpretation of the results has been carried out considering the methodology- and data-related assumptions and limitations declared in the EPD. This interpretation section focuses on the environmental impact categories as well as the primary energy demand indicators only.

Global Warming Potential (GWP)

The majority of the life cycle GWP impact occurs in the production phase (A1-A3). A1-A3 impacts account for 91.71% overall life cycle impacts for this category. The most significant contributions to production phase impacts are the upstream production of raw materials used in the steelmaking process, generation/supply of electricity and the production/use of fuels on site. Fabrication, installation and the end-of-life processes covered in C1-C4 make a minimal contribution to GWP. For overall climate change impacts, carbon dioxide emissions account for the majority of impacts with methane being the second most significant contributor.

Ozone Depletion Potential (ODP)

The majority of impacts are associated with the production phase (A1-3). Significant contributions to production phase impact come from the emission of ozone depleting substances during the upstream production of raw materials/pre-products as well as those arising from electricity production. Module D shows a very small credit even though scrap burdens are being assessed in this phase. This is explained because ODP emissions are linked to grid electricity production used.

Acidification Potential (AP)

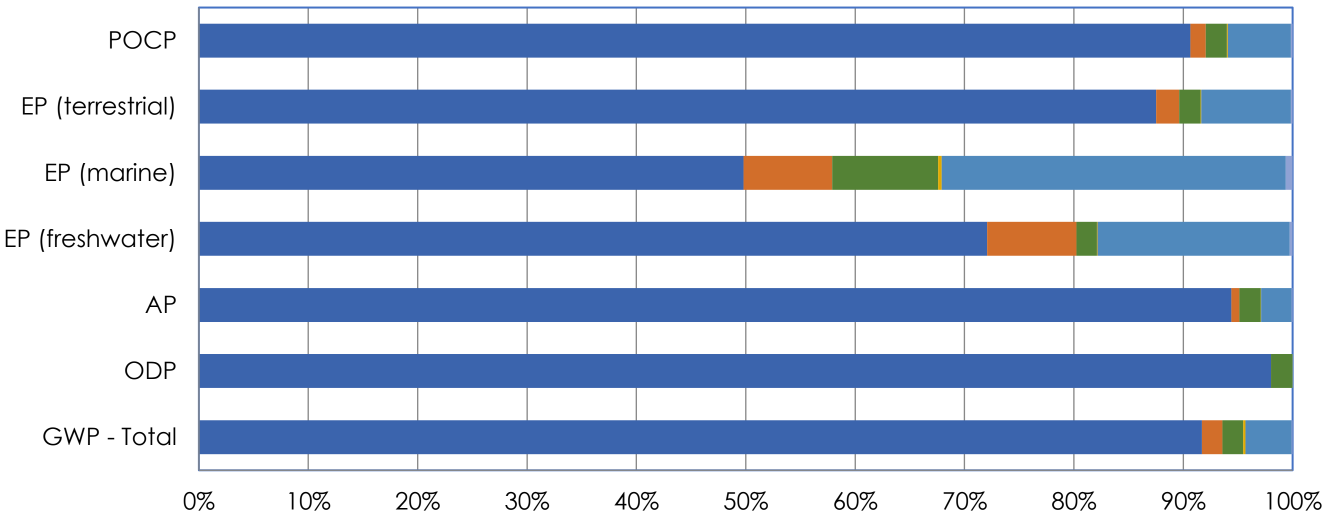
Acidification potential is generally driven by the production of sulphur dioxide and nitrogen oxides through the combustion of fossil fuels, particularly coal and crude oil products. The majority of the lifecycle AP impact occurs in the production phase (A1-A3), similar to GWP. The major contributors to production phase AP impacts comes from energy resources used in the production of the raw materials and pre-products for the steelmaking process and from transportation. Fabrication, installation and the end-of-life processes classed under C1-C4 make minimal contributions.

Eutrophication Potential (EP)

Eutrophication is driven by nitrogen and phosphorus containing emissions and as with GWP and AP is often strongly linked with the use of fossil fuels. The major eutrophication impacts occur in the production phase (A1-A3). Significant contributions to production phase impact comes from the production of raw materials and transport. Fabrication, installation and the end-of-life processes classed under C1-C4 again make minimal contributions.

Photochemical Ozone Creation Potential (POCP)

POCP tends to be driven by emissions of carbon monoxide, nitrogen oxides (NOx), sulphur dioxide and NMVOCs. The production phase is the dominant phase of the lifecycle with regards to POCP impacts. Again, these are all emissions commonly associated with the combustion of fuels. Significant contributors to POCP are the upstream production of raw materials/pre-products and transport, directly linked to fossil fuel combustion. It should be noted that the impacts for steel recycling in module D is almost of the same magnitude as the production phase impacts.



	GWP - Total	ODP	AP	EP (freshwater)	EP (marine)	EP (terrestrial)	POCP
A1-3	91.71%	98.04%	94.39%	72.07%	49.81%	87.51%	90.65%
A4	1.85%	0.00%	0.75%	8.17%	8.11%	2.13%	1.41%
A5	1.92%	1.96%	1.95%	1.88%	9.67%	1.94%	1.94%
C1	0.19%	0.00%	0.04%	0.04%	0.32%	0.08%	0.09%
C2	4.21%	0.00%	2.77%	17.58%	31.48%	8.18%	5.75%
C3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C4	0.10%	0.00%	0.10%	0.26%	0.61%	0.16%	0.16%

Figure 1 - shows the relative contribution of each life cycle stage to different environmental indicators for the high tensile steel strand products for the prestressing of concrete manufactured by the secondary (scrap-based) production route

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 for Experts (LCA FE) Software System and Database for Life Cycle Engineering, Sphera Solution GmbH, Leinfelden-Echterdingen, 2021

LCA for Experts (LCA FE) dataset documentation for the LCA FE Software System and Database for Life Cycle Engineering, Sphera Solution GmbH, Leinfelden-Echterdingen, 2021

International Energy Agency, Energy Statistics 2013. http://www.iea.org

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

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 CARES Post Tensioning Systems for Concrete Structures Scheme Appendix PT8 - Quality and operations assessment schedule for high tensile steel wire and strand for the prestressing of concrete - https://www.carescertification.com/certified-companies/search - Certificate number of conformance to BS 5896 at the time of LCA study – 220806

BS 5896:2012 High tensile steel wire and strand for the prestressing of concrete. Specification

ASTM A416/A416M-18 Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete

AS/NZS 4672.1:2007 Steel prestressing materials Part 1: General requirements

prEN 10138-2 - 2022 Prestressing steels - Part 2: Strand

GB/T 5224-2023 Steel strand for prestressed concrete

ISO 6934-1:1991 Steel for the prestressing of concrete Part 1: General requirements

ISO 6934-4:2020 Steel for the prestressing of concrete Part 4: Strand

JIS G 3536:2014 Steel wires and strands for prestressed concrete