Environmental Product Declaration

Statement of Verification

CARES EPD No.: 0044

Issue 01

This is to verify that the

Environmental Product Declaration

Provided by:

Southern PC Steel Sdn Bhd

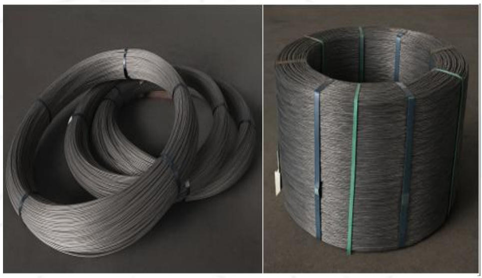
Is in accordance with the requirements of:
ISO 14025:2010 and EN 15804:2012 + A2:2019/AC2021
and CARES PCR for Type III EPD of Semi-Finished and Finished Steel Products, February 2025

This declaration is for: 1 tonne of high tensile steel wire and strand products for the prestressing of concrete manufactured by the primary production route (iron ore)

Company address:

No.5, Jalan Utas 15/7,
Seksyen 15,
40200 Shah Alam
Selangor
Malaysia

南達 Southern PC Steel



LadinCamci

	Ladin Camci	26 January 2026
Signed for CARES	Operator	Date of this Issue
26 January 2026		25 January 2029
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 0044

General Information

EPD Programme Operator	CARES Pembroke House, 21 Pembroke Road, Sevenoaks, Kent, TN13 1XR UK www.carescertification.com
Applicable Product Category Rules	CARES Product Category Rules (PCR) for Type III Environmental Product Declaration (EPD) of Semi-Finished and Finished Steel Products, February 2025
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 3.0 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 wire and strand products for the prestressing of concrete manufactured by the primary production route (iron ore)
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/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

Southern PC Steel Sdn Bhd
No.5, Jalan Utas 15/7, Seksyen 15
40200 Shah Alam
Selangor
Malaysia

Construction Product:

Product Description

Plain or indented high tensile steel wire for the prestressing of concrete is obtained by cold drawing of high carbon steel wire rods into various sizes (according to product standards listed in References) which are manufactured by hot rolling of continuously cast steel billets obtained from the blast furnace/basic oxygen furnace production route.

High tensile prestressed steel strand for the prestressing of 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 blast furnace/basic oxygen furnace production route.

High tensile prestressed steel wire and strand for the prestressing of concrete is used to provide tensile strength in reinforced concrete structural elements.

The declared unit is 1 tonne of high tensile steel wire and strand products for the prestressing of concrete manufactured by the primary production route (iron ore).

Technical Information

Property	Value, Unit
Production route	Blast Furnace - BOF
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)	13.6 [1)]

1) CARES BF-BOF manufacturing route average including internal and external scrap

Main Product Contents

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

Manufacturing Process

High tensile steel wire for prestressing applications is manufactured from high-carbon steel wire rods that are manufactured through the primary production route (blast furnace/basic oxygen furnace). The rods undergo thorough cleaning and descaling to remove surface impurities, followed by cold drawing through a series of dies to achieve the required diameter and enhance tensile strength. After drawing, the wire is subjected to stress-relieving heat treatment under controlled tension to reduce residual stresses and improve relaxation characteristics.

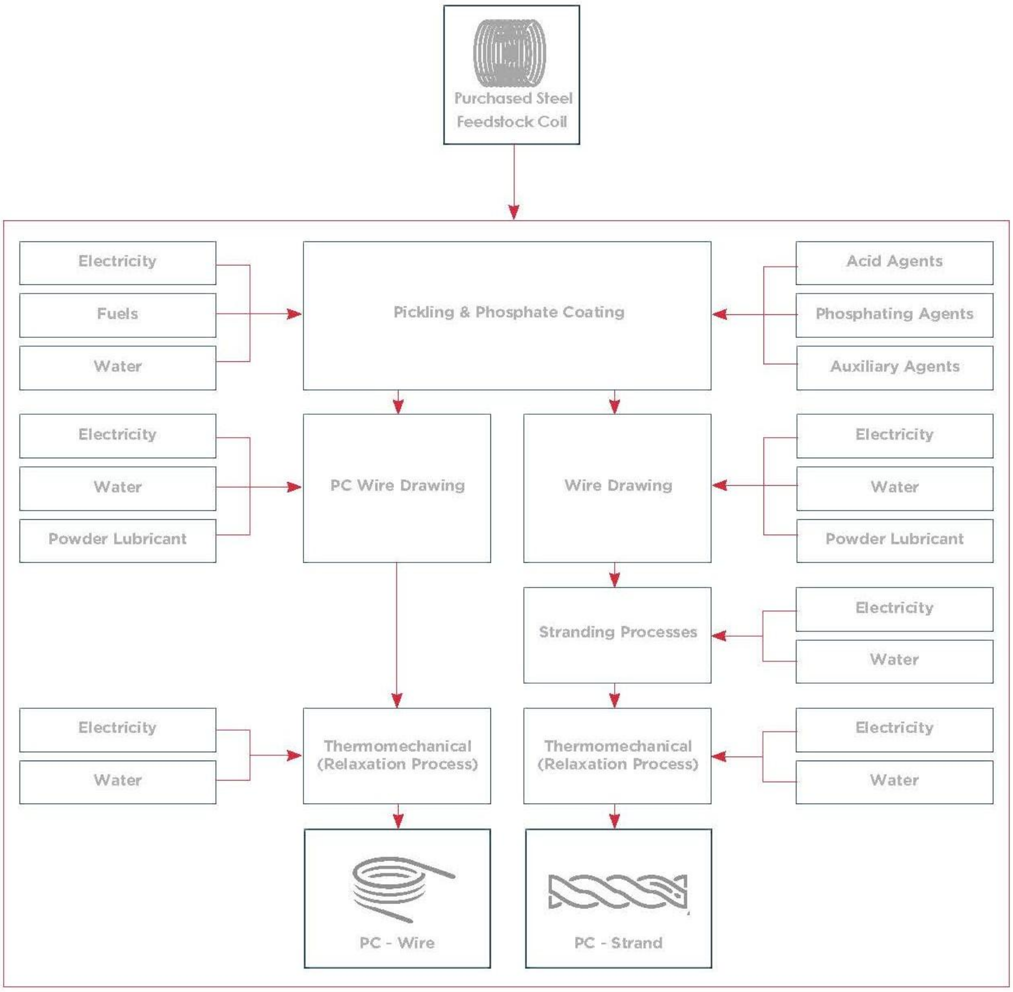
High tensile steel strand for the prestressing of concrete, is produced by helically twisting multiple wires in a stranding machine. Following stranding, the product undergoes stress-relieving heat treatment under tension to stabilise mechanical properties and enhance relaxation performance.

The completed wires and strands (according to the product standards listed in the references section of this EPD) are subjected to rigorous quality control, including tensile strength verification, lay length measurement, and surface inspection, prior to coiling and dispatch for prestressing operations.

Finished wires and strands are coiled and packaged for transport, ensuring protection against corrosion and mechanical damage. Steel straps and ties used for the binding of packages 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.

Process flow diagram

PC-wire & strand manufacturing process



Construction Installation

Processing and proper use of high tensile steel wire and 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 wire and 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 wire and strand products does not change during use.

High tensile steel wire and 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 wire and strand products itself.

End of Life

High tensile steel wire and 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 wire and 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. For all indicators the characterisation factors from the Environmental Footprint v3.1 (EF 3.1) was applied.

Declared unit description

1 tonne of high tensile steel wire and strand products for the prestressing of concrete manufactured by the primary production route (iron ore).

System boundary

The system boundary of the EPD follows the modular design defined by EN 15804:2012+A2:2019/AC2021. 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 01/01/2023 - 31/12/2023 has been provided by Southern PC Steel Sdn Bhd operating on the geographical area noted in Manufacturing Site. High carbon steel wire rods used in the production of high tensile steel wire and strand for the prestressing of concrete were purchased from external suppliers which are using the primary production route (iron ore 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 15804:2012+A2:2019/AC2021. The EPD covers transport to, and end-of-life in Malaysia.

The selection of the background data for electricity generation is in line with the CARES PCR 2025. Country or region-specific power grid mixes are selected from MLC (GaBi) Databases 2025.1 (Sphera, 2025); thus, consumption grid mix of Malaysia 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 Malaysia in 0.778 kg CO_2 eq/kWh.

Data Quality: Background data is consistently sourced from the MLC (GaBi) Databases 2025.1 (Sphera, 2025). The primary data collection was thorough, considering all relevant flows and these data have been verified during the audit conducted by CARES in July 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/AC2021, Annex E, Table E.1 — Data quality level and criteria of the UN Environment Global Guidance on LCA database development. No 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 and the mill scale based on economic value. The revenue generated from mill scale is less than 1% in relation to the product based on current market prices, this co-product is of definite value and are freely/readily traded in reality. For this reason, economic allocation has been applied to the processes where this co-product arises.

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 MLC (GaBi) Databases 2025.1 (Sphera, 2025).

Biogenic carbon accounting:

Biogenic carbon is modelled on a dry-mass basis per EN 16449 with $CO_2 = C \times 44/12$. Under the EN 15804 EF 3.1 configuration, characterization factors are −1 for CO_2 uptake and +1 for CO_2 release; module placement follows the physical process packaging uptake in A3; release on incineration in A5.

PERM (A3) is reported as renewable primary energy used as material and is calculated from dry mass × net calorific value.

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).

LCA Results - High tensile steel wire for the prestressing of concrete

(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	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	2.37E+03	2.37E+03	3.48	1.420	9.02E-09	5.53	1.83E-03
	Transport	A2	65.2	65.0	0.073	0.085	6.37E-12	1.91	3.64E-05
	Manufacturing	A3	376	372	-1.07	0.571	6.27E-10	1.61	1.56E-04
	Total (of product stage)	A1-3	2.81E+03	2.81E+03	2.48	2.08	9.65E-09	9.05	2.02E-03
Construction process stage	Transport	A4	25.2	24.9	0.048	0.264	3.02E-12	0.038	6.92E-05
	Construction	A5	57.2	57.1	1.07	0.051	1.93E-10	0.184	4.29E-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	2.09	2.09	8.33E-04	6.83E-05	1.62E-13	0.012	2.52E-07
	Transport	C2	48.4	47.8	0.090	0.477	5.75E-12	0.120	1.26E-04
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.23	1.22	3.96E-05	0.005	3.40E-12	0.009	1.82E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.62E+03	-1.62E+03	1.42	-1.30	-7.11E-10	-4.63	-8.22E-04
100% Landfill Scenario									
End of life	Deconstruction, demolition	C1	2.09	2.09	8.33E-04	6.83E-05	1.62E-13	0.012	2.52E-07
	Transport	C2	2.23	2.20	0.004	0.023	2.67E-13	0.003	6.11E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	15.3	15.3	4.95E-04	0.063	4.25E-11	0.108	2.27E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.47E+02	1.46E+02	1.30	-0.578	2.24E-10	-0.814	-2.75E-04
100% Recycling Scenario									
End of life	Deconstruction, demolition	C1	2.09	2.09	8.33E-04	6.83E-05	1.62E-13	0.012	2.52E-07
	Transport	C2	52.4	51.8	0.097	0.516	6.22E-12	0.131	1.36E-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	-1.84E+03	-1.84E+03	1.77	-1.55	-7.90E-10	-5.38	-9.70E-04

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 - High tensile steel wire for the prestressing of concrete (cont.)

(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	m^3 world eq deprived
Product stage	Raw material supply	A1	1.35	14.8	4.56	1.04E-04	2.10E+04	122
	Transport	A2	0.450	4.93	1.29	1.97E-06	773	0.139
	Manufacturing	A3	0.506	5.52	1.37	1.15E-05	4.53E+03	-15.4
	Total (of product stage)	A1-3	2.31	25.3	7.22	1.17E-04	2.63E+04	106.7
Construction process stage	Transport	A4	0.015	0.163	0.033	1.70E-06	327	0.103
	Construction	A5	0.047	0.52	0.147	2.40E-06	539	2.15
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	4.08E-03	0.045	0.011	2.94E-08	27.7	0.016
	Transport	C2	0.054	0.580	0.129	3.15E-06	626	0.191
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.002	0.025	0.007	7.57E-08	16.0	0.132
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-0.975	-10.5	-3.21	-6.73E-03	-1.34E+04	-105
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	0.045	0.011	2.94E-08	27.7	0.016
	Transport	C2	1.40E-03	0.015	0.003	1.50E-07	28.8	0.009
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.028	0.308	0.085	9.46E-07	200	1.65
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-0.019	-0.221	0.018	-8.60E-03	-3.09E+02	-118
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	0.045	0.011	2.94E-08	27.7	0.016
	Transport	C2	0.058	0.630	0.140	3.41E-06	678	0.207
	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	-1.12	-12.1	-3.67	-8.62E-03	-1.54E+04	-132

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 - High tensile steel wire for the prestressing of concrete (cont.)

(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 U235 eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	8.09E-05	9.39	4.93E+03	3.07E-06	8.46E-06	1.28E+03
	Transport	A2	3.32E-05	0.128	622	9.28E-09	2.25E-07	47.3
	Manufacturing	A3	1.33E-05	1.16	658	4.75E-08	7.03E-07	410
	Total (of product stage)	A1-3	1.27E-04	10.7	6.21E+03	3.13E-06	9.39E-06	1.74E+03
Construction process stage	Transport	A4	3.73E-07	0.060	424	5.70E-09	3.22E-07	145
	Construction	A5	2.58E-06	0.216	140	6.28E-08	2.00E-07	40.0
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	7.82E-08	5.77E-04	32.9	5.92E-10	7.53E-09	0.036
	Transport	C2	1.45E-06	0.113	792	1.07E-08	5.87E-07	262
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.08E-07	0.019	13.8	2.13E-10	7.98E-09	3.96
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-7.80E-05	16.3	-3.14E+03	-5.69E-06	5.51E-07	465
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	32.9	5.92E-10	7.53E-09	0.036
	Transport	C2	3.23E-08	0.005	37.4	5.03E-10	2.84E-08	12.8
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.35E-06	0.235	173	2.67E-09	9.98E-08	49.5
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.46E-05	-8.32	-1.39E+03	-3.74E-06	-1.98E-06	-768
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	32.9	5.92E-10	7.53E-09	0.036
	Transport	C2	1.57E-06	0.123	858	1.16E-08	6.36E-07	284
	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	-9.19E-05	17.8	-3.74E+03	-6.91E-06	4.19E-07	450

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 - High tensile steel wire for the prestressing of concrete (cont.)

(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	1.80E+03	0	1.80E+03	2.10E+04	0	2.10E+04
	Transport	A2	10.9	0	10.9	773	0	773
	Manufacturing	A3	588	9.99	598	4.53E+03	0	4.53E+03
	Total (of product stage)	A1-3	2.40E+03	9.99	2.41E+03	2.63E+04	0	2.63E+04
Construction process stage	Transport	A4	24.0	0	24.0	327	0	327
	Construction	A5	48.8	0	48.8	539	0	539
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	0.056	0	0.056	27.7	0	27.7
	Transport	C2	43.6	0	43.6	626	0	626
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	3.09	0	3.09	16.0	0	16.0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	1.13E+03	0	1.13E+03	-1.34E+04	0	-1.34E+04
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	0.056	0	0.056	27.7	0	27.7
	Transport	C2	2.12	0	2.12	28.8	0	28.8
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	38.7	0	38.7	200	0	200
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.21E+03	0	-1.21E+03	-3.09E+02	0	-3.09E+02
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	0.056	0	0.056	27.7	0	27.7
	Transport	C2	47.2	0	47.2	678	0	678
	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	1.17E+03	0	1.17E+03	-1.54E+04	0	-1.54E+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 - High tensile steel wire for the prestressing of concrete (cont.)

(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	223	0	0	4.67
	Transport	A2	0	0	0	0.008
	Manufacturing	A3	0	0	0	1.36
	Total (of product stage)	A1-3	223	0	0	6.04
Construction process stage	Transport	A4	0	0	0	0.012
	Construction	A5	4.46	0	0	0.121
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	4.04E-04
	Transport	C2	0	0	0	0.021
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.004
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	938	0	0	-4.69
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	1.02E-03
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.048
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	-4.72
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	0.023
	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	1.02E+03	0	0	-5.87

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 - High tensile steel wire for the prestressing of concrete (cont.)

(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	2.68E-06	36.9	0.104
	Transport	A2	2.70E-08	0.068	9.30E-04
	Manufacturing	A3	3.18E-07	1.56	0.009
	Total (of product stage)	A1-3	3.03E-06	38.5	0.114
Construction process stage	Transport	A4	1.18E-08	0.043	4.30E-04
	Construction	A5	6.10E-08	2.37	0.002
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	4.71E-10	0.004	7.85E-06
	Transport	C2	2.26E-08	0.081	8.18E-04
	Waste processing	C3	0	0	0
	Disposal	C4	3.51E-09	80.1	1.70E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.60E-02	-18.9	0.157
100% Landfill Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	0.004	7.85E-06
	Transport	C2	1.04E-09	0.004	3.80E-05
	Waste processing	C3	0	0	0
	Disposal	C4	4.38E-08	1.00E+03	0.002
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.33E-02	10.0	-0.079
100% Recycling Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	0.004	7.85E-06
	Transport	C2	2.45E-08	0.087	8.86E-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	-3.33E-02	-20.5	0.171

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

LCA Results - High tensile steel wire for the prestressing of concrete (cont.)

(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
			kg	kg	kg	MJ per energy carrier
Product stage	Raw material supply	A1	0	0	0	0
	Transport	A2	0	0	0	0
	Manufacturing	A3	0	0	0	0
	Total (of product stage)	A1-3	0	0	0	0
Construction process stage	Transport	A4	0	0	0	0
	Construction	A5	0	18.4	0	0
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	920	0	0
	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	0
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0
	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	0
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	1.00E+03	0	0
	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	0

CRU = Components for reuse;
MFR = Materials for recycling
MER = Materials for energy recovery;
EE = Exported Energy

LCA Results - High tensile steel strand for the prestressing of concrete

(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	2.40E+03	2.39E+03	3.52	1.44	9.13E-09	5.60	1.85E-03
	Transport	A2	65.9	65.8	0.074	0.086	6.44E-12	1.93	3.68E-05
	Manufacturing	A3	372	373	-5.59	0.573	6.31E-10	1.62	1.58E-04
	Total (of product stage)	A1-3	2.84E+03	2.83E+03	-2.00	2.10	9.77E-09	9.15	2.04E-03
Construction process stage	Transport	A4	25.2	24.9	0.048	0.264	3.02E-12	0.038	6.92E-05
	Construction	A5	57.7	57.6	5.59	0.052	1.95E-10	0.185	4.34E-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	2.09	2.09	8.33E-04	6.83E-05	1.62E-13	0.012	2.52E-07
	Transport	C2	48.4	47.8	0.090	0.477	5.75E-12	0.120	1.26E-04
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	1.23	1.22	3.96E-05	0.005	3.40E-12	0.009	1.82E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.68E+03	-1.68E+03	1.73	-1.47	-7.09E-10	-5.02	-9.14E-04
100% Landfill Scenario									
End of life	Deconstruction, demolition	C1	2.09	2.09	8.33E-04	6.83E-05	1.62E-13	0.012	2.52E-07
	Transport	C2	2.23	2.20	0.004	0.023	2.67E-13	0.003	6.11E-06
	Waste processing	C3	0	0	0	0	0	0	0
	Disposal	C4	15.3	15.3	4.95E-04	0.063	4.25E-11	0.108	2.27E-05
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	147	146	1.30	-0.578	2.24E-10	-0.814	-2.75E-04
100% Recycling Scenario									
End of life	Deconstruction, demolition	C1	2.09	2.09	8.33E-04	6.83E-05	1.62E-13	0.012	2.52E-07
	Transport	C2	52.4	51.8	0.097	0.516	6.22E-12	0.131	1.36E-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	-1.84E+03	-1.84E+03	1.77	-1.55	-7.90E-10	-5.38	-9.70E-04

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 - High tensile steel strand for the prestressing of concrete (cont.)

(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	m^3 world eq deprived
Product stage	Raw material supply	A1	1.37	14.9	4.61	1.05E-04	2.12E+04	124.0
	Transport	A2	0.455	4.98	1.30	1.99E-06	782	0.140
	Manufacturing	A3	0.508	5.54	1.38	1.15E-05	4.55E+03	-15.5
	Total (of product stage)	A1-3	2.33	25.4	7.29	1.18E-04	2.65E+04	108.6
Construction process stage	Transport	A4	0.015	0.163	0.033	1.70E-06	327	0.103
	Construction	A5	0.048	0.521	0.148	2.43E-06	544	2.17
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	4.08E-03	0.045	0.011	2.94E-08	27.7	0.016
	Transport	C2	0.054	0.580	0.129	3.15E-06	626	0.191
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.002	0.025	0.007	7.57E-08	16.0	0.132
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.03	-11.1	-3.38	-8.61E-03	-1.42E+04	-131
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	0.045	0.011	2.94E-08	27.7	0.016
	Transport	C2	1.40E-03	0.015	0.003	1.50E-07	28.8	0.009
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	0.028	0.308	0.085	9.46E-07	200	1.65
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-0.019	-0.221	0.018	-8.60E-03	-309	-118
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	4.08E-03	0.045	0.011	2.94E-08	27.7	0.016
	Transport	C2	0.058	0.630	0.140	3.41E-06	678	0.207
	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	-1.12	-12.1	-3.67	-8.62E-03	-1.54E+04	-132

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 - High tensile steel strand for the prestressing of concrete (cont.)

(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 U235 eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	8.18E-05	9.50	4980	3.11E-06	8.56E-06	1290
	Transport	A2	3.36E-05	0.129	629	9.38E-09	2.27E-07	47.9
	Manufacturing	A3	1.34E-05	1.22	6.65E+02	4.78E-08	7.07E-07	483
	Total (of product stage)	A1-3	1.29E-04	10.9	6.27E+03	3.17E-06	9.49E-06	1.82E+03
Construction process stage	Transport	A4	3.73E-07	0.060	424	5.70E-09	3.22E-07	145
	Construction	A5	2.61E-06	0.220	142	6.35E-08	2.02E-07	4.18E+01
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	7.82E-08	5.77E-04	32.9	5.92E-10	7.53E-09	0.036
	Transport	C2	1.45E-06	0.113	792	1.07E-08	5.87E-07	262
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.08E-07	0.019	13.8	2.13E-10	7.98E-09	3.96
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.65E-05	15.7	-3550	-6.65E-06	2.27E-07	353
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	32.9	5.92E-10	7.53E-09	0.036
	Transport	C2	3.23E-08	0.005	37.4	5.03E-10	2.84E-08	12.8
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	1.35E-06	0.235	173	2.67E-09	9.98E-08	49.5
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-2.46E-05	-8.3	-1.39E+03	-3.74E-06	-1.98E-06	-7.68E+02
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	7.82E-08	5.77E-04	32.9	5.92E-10	7.53E-09	0.036
	Transport	C2	1.57E-06	0.123	858	1.16E-08	6.36E-07	284
	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	-9.19E-05	17.8	-3740	-6.91E-06	4.19E-07	450

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 - High tensile steel strand for the prestressing of concrete (cont.)

(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	1.82E+03	0	1.82E+03	2.12E+04	0	2.12E+04
	Transport	A2	11.0	0	11.0	782	0	782
	Manufacturing	A3	656	56.8	713	4.55E+03	0	4.55E+03
	Total (of product stage)	A1-3	2.49E+03	56.8	2.54E+03	2.65E+04	0	2.65E+04
Construction process stage	Transport	A4	24.0	0	24.0	327	0	327
	Construction	A5	50.6	0	50.6	544	0	544
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	0.056	0	0.056	27.7	0	27.7
	Transport	C2	43.6	0	43.6	626	0	626
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	3.09	0	3.09	16.0	0	16.0
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	976	0	976	-1.42E+04	0	-1.42E+04
100% Landfill Scenario								
End of life	Deconstruction, demolition	C1	0.056	0	0.056	27.7	0	27.7
	Transport	C2	2.12	0	2.12	28.8	0	28.8
	Waste processing	C3	0	0	0	0	0	0
	Disposal	C4	38.7	0	38.7	200	0	200
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.21E+03	0	-1.21E+03	-309	0	-309
100% Recycling Scenario								
End of life	Deconstruction, demolition	C1	0.056	0	0.056	27.7	0	27.7
	Transport	C2	47.2	0	47.2	678	0	678
	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	1.17E+03	0	1.17E+03	-1.54E+04	0	-1.54E+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 - High tensile steel strand for the prestressing of concrete (cont.)

(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	225	0	0	4.72
	Transport	A2	0	0	0	0.008
	Manufacturing	A3	0	0	0	1.39
	Total (of product stage)	A1-3	225	0	0	6.12
Construction process stage	Transport	A4	0	0	0	0.012
	Construction	A5	4.51	0	0	0.123
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	4.04E-04
	Transport	C2	0	0	0	0.021
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.004
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	938	0	0	-5.78
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	1.02E-03
	Waste processing	C3	0	0	0	0
	Disposal	C4	0	0	0	0.048
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0	0	0	-4.72
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	4.04E-04
	Transport	C2	0	0	0	0.023
	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	1.02E+03	0	0	-5.87

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 - High tensile steel strand for the prestressing of concrete (cont.)

(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	2.71E-06	37.40	0.106
	Transport	A2	2.73E-08	0.068	9.41E-04
	Manufacturing	A3	3.28E-07	1.58	0.009
	Total (of product stage)	A1-3	3.07E-06	39.0	0.116
Construction process stage	Transport	A4	1.18E-08	0.043	4.30E-04
	Construction	A5	6.18E-08	2.38	0.002
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	4.71E-10	0.004	7.85E-06
	Transport	C2	2.26E-08	0.081	8.18E-04
	Waste processing	C3			
	Disposal	C4	3.51E-09	80.1	1.70E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.33E-02	-18.1	0.151
100% Landfill Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	0.004	7.85E-06
	Transport	C2	1.04E-09	0.004	3.80E-05
	Waste processing	C3			
	Disposal	C4	4.38E-08	1.00E+03	0.002
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.33E-02	10.0	-0.079
100% Recycling Scenario					
End of life	Deconstruction, demolition	C1	4.71E-10	0.004	7.85E-06
	Transport	C2	2.45E-08	0.087	8.86E-04
	Waste processing	C3			
	Disposal	C4			
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-3.33E-02	-20.5	0.171

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

LCA Results - High tensile steel strand for the prestressing of concrete (cont.)

(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
			kg	kg	kg	MJ per energy carrier
Product stage	Raw material supply	A1	0	0	0	0
	Transport	A2	0	0	0	0
	Manufacturing	A3	0	0	0	0
	Total (of product stage)	A1-3	0	0	0	0
Construction process stage	Transport	A4	0	0	0	0
	Construction	A5	0	18.4	0	0
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	920	0	0
	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	0
100% Landfill Scenario						
End of life	Deconstruction, demolition	C1	0	0	0	0
	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	0
100% Recycling Scenario						
End of life	Deconstruction, demolition	C1	0	1.00E+03	0	0
	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	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)	%	61
	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. Packaging is assumed to be 100% incinerated at installation. In alignment with EN 15804+A2 (EF 3.1), biogenic CO_2 uptake associated with packaging is declared in A1–A3 (negative sign), and the corresponding release is declared in A5 (positive sign) with equal magnitude.		
	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	%	61
	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

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
	Transport to waste processing by Container ship – Capacity utilisation	%	53
	Transport to waste processing by Container ship – Density of Product	kg/m³	7810
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 steel plant 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. A large amount of net scrap is generated over the life cycle as the primary production route (with BF/BOF) 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	136
	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

Iron ore based high tensile steel wire and strand products for the prestressing of concrete of Southern PC Steel Sdn Bhd is made via the primary 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 15804:2012+A2:2019/AC2021.

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 95.47% 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)

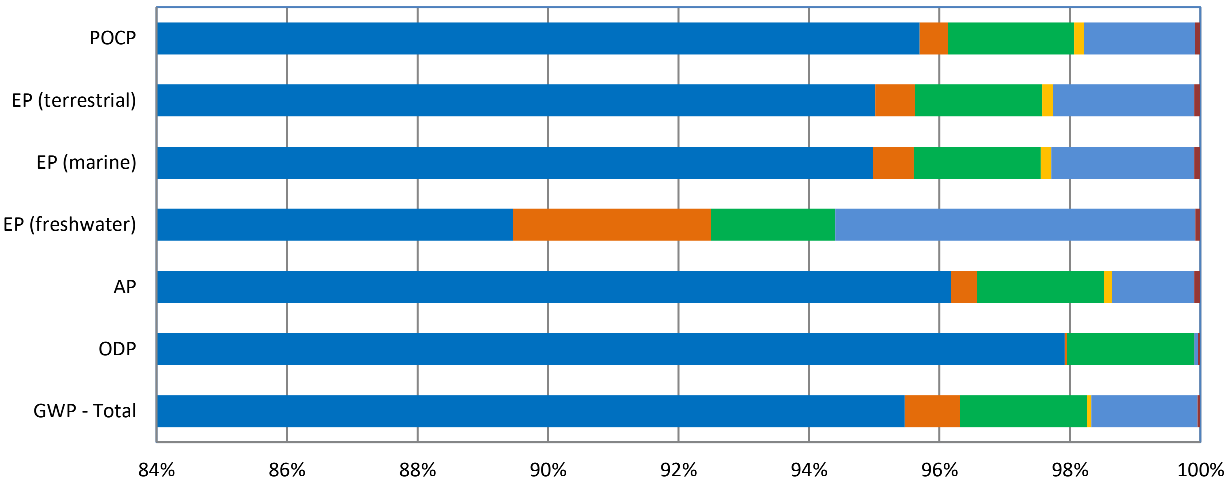
Acidification potential is generally driven by the production of sulphur dioxide and nitrogen oxides through the combustion of fossil fuels, particularly coal and crude oil products. The majority of the lifecycle AP impact occurs in the production phase (A1-A3), similar to GWP. The major contributors 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	95.47%	97.92%	96.18%	89.47%	94.98%	95.02%	95.69%
A4	0.85%	0.03%	0.40%	3.03%	0.63%	0.61%	0.43%
A5	1.94%	1.95%	1.94%	1.90%	1.94%	1.95%	1.94%
C1	0.07%	0.00%	0.12%	0.01%	0.17%	0.17%	0.15%
C2	1.63%	0.06%	1.26%	5.51%	2.19%	2.17%	1.69%
C3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
C4	0.04%	0.03%	0.09%	0.08%	0.09%	0.09%	0.09%

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 primary production route (iron ore)

Information on biogenic carbon content

Biogenic carbon content	kg C
Biogenic carbon content in product (high tensile steel wire for the prestressing of concrete)	0
Biogenic carbon content in product (high tensile steel strand for the prestressing of concrete)	0
Biogenic carbon content in accompanying packaging (high tensile steel wire for the prestressing of concrete)	0.29
Biogenic carbon content in accompanying packaging (high tensile steel strand for the prestressing of concrete)	1.53

NOTE 1 kg biogenic carbon is equivalent to 44/12 kg of CO_2

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