

ENVIRONMENTAL PRODUCT DECLARATION

HOT ROLLED COIL/CHECKERED COIL/STEEL SHEET

STRUCTURAL STEEL



TOKYO STEEL MANUFACTURING CO., LTD. started out as a small steel maker in Tokyo almost 80 years ago. It has since grown into Japan's leading electric-arc-furnace steelmaker with an annual production of several million tons.

Tokyo Steel prides itself as a recycler of steel scrap - its primary raw material - letting it protect the environment and thus contribute to society. Recycling of steel products with the electric arc furnace process is truly the most effective in terms of achieving a recycling-based society and low-carbon society at the same time. To contribute to Japan's target of reducing greenhouse gas (GHG) emissions by 80% by 2050 while making advanced use of steel scrap that, in aggregate, amounts to several decades' worth of domestic steel demand, Tokyo Steel will work, with strong determination, to provide even more diverse customers with a wide range of products.




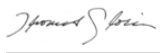
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Hot Rolled Coil/Checkered Coil/Steel Sheet
Structural Steel

According to ISO 14025
EN15804 and ISO 21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Environment 333 Pfingsten Road Northbrook, IL 60611	https://www.ul.com/ https://spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	General Program Instructions v.2.4 July 2018	
MANUFACTURER NAME AND ADDRESS	Tokyo Steel Manufacturing Co. Ltd.	
DECLARATION NUMBER	4788852729.101.1	
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Hot Rolled Coil/Checkered Coil Structural Steel, 1 metric ton	
REFERENCE PCR AND VERSION NUMBER	<ul style="list-style-type: none"> - Product Category Rules for Building-Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL Environment, Standard 10010, Version 3.1 - IBU Part B: Requirements on the EPD for Structural steels Version 1.6 November 30 2017 - UL Product Category Rules for preparing an environmental product declaration for Part B: Requirements on the EPD for Structural steels (ADDENDUM, VERSION 1.1, December, 2017) 	
DESCRIPTION OF PRODUCT APPLICATION/USE	Structural steel "Hot Rolled Coil/Checkered Coil" is used in most buildings and civil works, mainly in structural steel constructions. In addition to the construction sector there are numerous applications in very diverse sectors.	
PRODUCT RSL DESCRIPTION (IF APPL.)	The Reference service life is not specified	
MARKETS OF APPLICABILITY	Japan	
DATE OF ISSUE	2019 October 1	
PERIOD OF VALIDITY	5 Years	
EPD TYPE	Product-Specific	
EPD SCOPE	Cradle to gate	
YEAR(S) OF REPORTED PRIMARY DATA	April 2017 and March 2018	
LCA SOFTWARE & VERSION NUMBER	IDEAv2.1.3 database (2017)	
LCI DATABASE(S) & VERSION NUMBER	IDEAv2.1.3 database (2017)	
LCIA METHODOLOGY & VERSION NUMBER	LIME2	

This PCR review was conducted by:	Institut Bauen und Umwelt e.V (IBU)
	PCR Review Panel
	PCR tested and approved by the SVR
This declaration was independently verified in accordance with ISO 14025: 2006. <input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL	 Grant R. Martin, UL Environment
	 Thomas P. Gloria, Industrial Ecology Consultants
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

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Product information

Product description

The product declared is structural steel “Hot Rolled Coil/Checkered Coil/Steel Sheet”, which is classified as “Floor plates” in the Section 2, Classification of Material of the AISC 303 - 10 Code of Standard Practice for Steel Buildings and Bridges. The production process used is the Electric Arc Furnace. This route, used by TOKYO STEEL for the production of structural steel, is based on the direct melting of scrap with an Electric Arc Furnace, which is subsequently processed in rolling mills in order to obtain the finished products. The steel section is hot rolled into structural steel in plate shape. No metallic or organic coating.

The product is provided for Japan market and complies with JIS G 3101/JIS G 3106/JIS G 3136/JIS G 3113/JIS G 3125/JIS G3132/JIS G 3131 (Regional designation code: JIS).



Application

Structural steel “Hot Rolled Steel Coil/Checkered Coil/Steel Sheet” is used in most buildings and civil works, mainly in structural steel constructions. In addition to the construction sector there are numerous applications in very diverse sectors.

Technical data

Name	Value	Unit
Density	7,874	kg/m ³
Modulus of elasticity	2.1	N/mm ²
Coefficient of thermal expansion	11.7	10 ⁻⁶ K ⁻¹
Thermal conductivity	80.2	W/(mK)
Melting point	1370	°C
Electrical conductivity at 20C	1,030	Ω ⁻¹ m ⁻¹
Minimum yield strength	215	N/mm ²
Minimum tensile strength	315	N/mm ²
Minimum elongation	16	%
Tensile strength	436	N/mm ²
Compressive strength	235	N/mm ²
Grade of material according to the delivery standards	SS400 etc	-



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Delivery status

The delivery conditions and dimension may vary according to the intended application.

Base materials / Ancillary materials

Structural steel “Hot Rolled Coil/Checkered Coil/Steel Sheet” is a low-alloy steel product. The typical content of carbon is lower than 0.18%. The share of other elements besides iron is typically below 1%. Steel scrap is a secondary raw material, defined in different qualities, depending on the composition (Fe content) and certain characteristics (plate, section steel, galvanized sheets, etc.).

The principal material is Steel and alloying elements are added on the form of ferroalloys and metals.

Any hazardous substances defined in Basel Convention and/or regulated by Japanese laws are not included in raw materials.

Manufacture

The steel scrap is melted in an electric arc furnace to obtain liquid steel, which is then refined in a ladle furnace with addition of ferroalloys and metals to obtain the required steel characteristics. The steel is then casted at a continuous caster to obtain semi-finished products. The semis are then rolled to the desired size.

TOKYO STEEL MFG produces the structural steel “Hot Rolled Coil/Checkered Coil/Steel Sheet”.

Factory	Address
TOKYO STEEL MFG Tahara Plant	2-1-3, Shirahama, Tahara-shi, Aichi 441-3436, Japan



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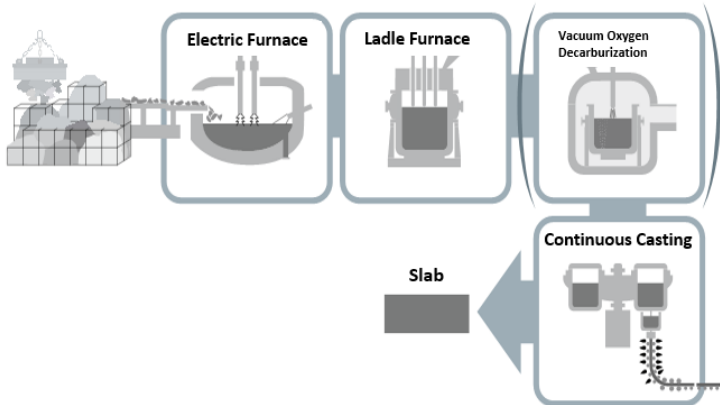


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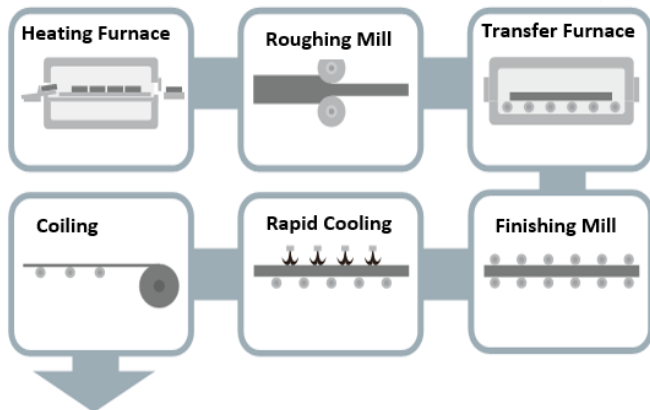
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Manufacturing process flow

Steelmaking Process



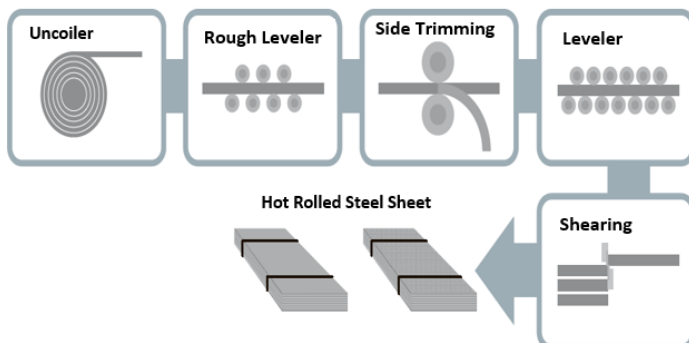
Rolling Process



Hot Rolled Coil/Checkered Coil



Leveler Process



Hot Rolled Steel Sheet



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Quality Management System

TOKYO STEEL MFG Tahara Plant is certified according to ISO9001 Quality Management System.

Environment and Health during manufacturing

TOKYO STEEL MFG Tahara Plant is certified according to ISO14001 Environment Management System.

Product processing/Installation

Processing and proper use of steel products depends on the application and should be made in accordance with generally accepted practices, standards and manufacturers recommendations. National technical regulations apply to the design and construction of steel structures. They deal with requirements for performance, sustainability, durability and fire resistance of steel and steel structures.

When handling and using the products, no additional means to protect health are required beyond the usual occupational safety measures.

No environmental impacts occur when working with or using these products under normal conditions of use. No special measures are necessary for the protection of the environment.

Residual materials are separated for in-house recycling. The steel scrap can be recycled almost completely.

Packaging

Structural steel "Hot Rolled Coil/Checkered Coil/Steel Sheet" is delivered unpacked.

Condition of use

During use no changes in material composition shall occur. Maintenance requirement will depend on specific design and application.

Environment and health during use

Steel products, under normal conditions of use, do not cause adverse health effects.

If the steel products are used according to their intended use, under normal conditions, there will be no significant environmental impact to water, air/atmosphere and soil.

Reference service life



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The Reference service life is not specified. This LCA study covers only Module A1 to A3 and there are many different applications.

Extraordinary effect

Fire: Structural steels are classified as incombustible materials according to Notification No. 1400 by Ministry of Construction Japan

Water: Not relevant

Mechanical destruction: Not relevant

Re-use phase

Hot Rolled Coil/Checkered Coil/Steel Sheet can be reused after its recovery, in particular when steel constructions are properly designed to facilitate disassembly and re-use at the end of their useful lives.

Steel is 100% recyclable and scrap can be converted to the same (or higher or lower) quality of steel depending upon the metallurgy and processing of the recycling route.

Disposal

Due to its high value as a resource, steel scrap is not disposed of, but instead in a well-established cycle fed to reuse or recycling. However, in case of disposal no environmental impacts result.

The disposal pathway in Japan: Recycling (99%), Landfill (1%), Incineration (0%)

Waste code according to Basel convention is

A1010: Metal wastes

And Waste classification according to Japanese national law "Waste Management Law" is

Industrial Waste: 1210 Steel scrap

Industrial Waste shall be collected by a licensed collector.

Further information

Additional information can be obtained from <http://www.tokyosteel.co.jp/>



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LCA Rules

Declared unit

Name	Value	Unit
Declared unit	1	metric ton
Density	7,874	kg/m ³
Conversion factor to 1kg	0.001	-
Thickness	1.45 - 25.0	mm

System boundary

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARYS
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

This is an EPD based on a cradle-to-gate life cycle assessment. The selected system boundaries of this study encompass the following steps:

- A1: Production of raw materials and energy
- A2: Transport of resources to the production site
- A3: Production of the product

Estimates and Assumptions

Regarding the transportation of materials, 80% of steel scraps is collected within 75km of the plant. The distance of transportation was set as 75km. 20% of steel scrap is transported from San Francisco port to Tokyo port. Assumed Coal coke would be transported from Melbourne port to Tokyo port because of the largest exporting country Australia.



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Cut-off rules

Regarding the transportation of resources, the transportations of primary materials (Steel scrap, Coal coke, Calcium oxide) have been considered. However, the transportations of other resources (1% of total resources) were ignored. The impact of this cut-off was reviewed in the section of Interpretation.

Except the above cut-off, all information from the data collection process has been considered, covering all used and registered materials, thermal energy, electrical energy and diesel consumption.

Background Data

Principally the inventory data include material, energy, auxiliary, water consumption (foreground data). The foreground data are derived from the Tahara Plant.

Further, LCA data sets (background data) linked to the foreground data of various stages of the life cycle (cradle to gate) were obtained from IDEAv2.1.3 database (2017).

Steel scrap is assumed to reach end of waste following a sorting and shredding process that takes place at demolition sites or waste processing facilities.

Data quality

All foreground data were collected at Utsunomiya Plant Between April 2017 and March 2018 (One year average data). Background data were used from IDEAv2.1.3 database (The data version is 2017).

Allocation

The manufacturing process generates by-products, Slag and internal circulation waste. All slag and internal circulation wastes outputs are input to this main product.

The measured Electricity was for all activities at Tahara plant, including structural steel manufacturing and other office activities. However, since electricity for other office activities was less than 1% of total electricity consumption, no electricity allocation was considered.

Tahara plant produce only Hot Rolled Coil/Checkered Coil/Steel Sheet. So all resources were allocated to this product Hot Rolled Coil/Checkered Coil/Steel Sheet. There was no co-product allocation.

Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /ISO 21930, EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.



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Life Cycle Assessment Results

Hot Rolled Coil/Checkered Coil

Environment Impact (Assessment Method: LIME2)		
Impact Category	Units	A1-A3
Global warming (GWP)	kg-CO ₂ eq	7.64E+02
Acidification (AP)	kg-SO ₂ eq	5.82E-01
Eutrophication (EP)	kgPO ₄ ³⁻ eq	4.19E-03
Ozone depletion (ODP)	kg-CFC-11eq	1.90E-06
Photo Chemical Ozone Creation (POCP)	kg-C ₂ H ₄ eq	1.23E-02

Resource Use		
Parameter	Units	A1-A3
Renewable primary energy as energy carrier	MJ	2.26E+02
Renewable primary energy resources as material utilization	MJ	1.32E+01
Total use of renewable primary energy resources	MJ	2.40E+02
Nonrenewable primary energy as energy carrier	MJ	2.17E+02
Nonrenewable primary energy as material utilization	MJ	4.18E+01
Total use of nonrenewable primary energy resources	MJ	2.59E+02
Use of secondary material	kg	1.12E+03
Use of renewable secondary fuels	MJ	-
Use of nonrenewable secondary fuels	MJ	-
Use of net fresh water	m ³	6.18E+02

Output Flows and Waste Categories		
Parameter	Units	A1-A3
Hazardous waste disposed	kg	1.60E+01
Nonhazardous waste disposed	kg	9.02E-02
Radioactive waste disposed	kg	-
Components for reuse	kg	-



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MFR Materials for recycling	kg	1.52E+02
MER Materials for energy recovery	kg	-
Exported Energy	MJ	-

Steel Sheet

Environment Impact (Assessment Method: LIME2)		
Impact Category	Units	A1-A3
Global warming (GWP)	kg-CO ₂ eq	7.70E+02
Acidification (AP)	kg-SO ₂ eq	5.82E-01
Eutrophication (EP)	kgPO ₄ ³⁻ eq	4.19E-03
Ozone depletion (ODP)	kg-CFC-11eq	1.90E-06
Photo Chemical Ozone Creation (POCP)	kg-C ₂ H ₄ eq	1.25E-02

Resource Use		
Parameter	Units	A1-A3
Renewable primary energy as energy carrier	MJ	2.30E+02
Renewable primary energy resources as material utilization	MJ	1.32E+01
Total use of renewable primary energy resources	MJ	2.43E+02
Nonrenewable primary energy as energy carrier	MJ	2.19E+02
Nonrenewable primary energy as material utilization	MJ	4.18E+01
Total use of nonrenewable primary energy resources	MJ	2.61E+02
Use of secondary material	kg	1.12E+03
Use of renewable secondary fuels	MJ	-
Use of nonrenewable secondary fuels	MJ	-
Use of net fresh water	m ³	6.18E+02

Output Flows and Waste Categories		
Parameter	Units	A1-A3
Hazardous waste disposed	kg	1.60E+01
Nonhazardous waste disposed	kg	9.02E-02



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Radioactive waste disposed	kg	-
Components for reuse	kg	-
MFR Materials for recycling	kg	2.23E+02
MER Materials for energy recovery	kg	-
Exported Energy	MJ	-

Interpretation

Completeness

Regarding the transportation of resources, the transportations of 1% resources (1% of total resources) were ignored. The impacts at the A2 transportation stage are below. If average 1% of impact at A2 transportation stage will be added, 0.0206% of GWP, 0.1365% of AP and 0.0954% of POCP could be increased.

Environment Impact (Assessment Method: LIME2)					
Impact Category	Units	A1-A3	A2	A2 impact of total	1% of A2 impact
GWP	kg-CO ₂ eq	7.64E+02	1.57E+01	2.06%	0.0206%
AP	kg-SO ₂ eq	5.82E-01	7.94E-02	13.65%	0.1365%
EP	kgPO ₄ ³⁻ eq	4.19E-03	9.08E-14	0.00%	0.0000%
ODP	kg-CFC-11eq	1.90E-06	1.03E-10	0.01%	0.0001%
POCP	kg-C ₂ H ₄ eq	1.23E-02	1.18E-03	9.54%	0.0954%

Sensitivity

Proxies were used for Ferro-chromium, Ferroboration, fluxing lime, Calcium aluminate, Calcium silicon because appropriate datasets were missing in IDEA database. The impacts of proxies are below. Especially Calcium aluminate (proxies: Aluminum) has most of the impact and and 99.38% of ODP impact.

Environment Impact (Assessment Method: LIME2)					
Impact Category	Units	A1-A3	Proxies	Impact of proxies	10% of proxies impact
GWP	kg-CO ₂ eq	7.64E+02	1.39E+01	1.82%	0.182%
AP	kg-SO ₂ eq	5.82E-01	7.70E-03	1.32%	0.132%
EP	kgPO ₄ ³⁻ eq	4.19E-03	4.41E-07	0.01%	0.001%
ODP	kg-CFC-11eq	1.90E-06	2.20E-07	11.57%	1.157%
POCP	kg-C ₂ H ₄ eq	1.23E-02	1.75E-04	1.41%	0.141%



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Consistency

All manufacturing data was gathered with the same level of detail and all background data were sourced from IDEA database selecting most appropriate geography.

Representativeness

There is one factory to produce Structural steel "Hot Rolled Coil/Checkered Coil/Steel Sheet". So this data can be used as representative.

References

- Institut Bauen und Umwelt e.V., Berlin(pub.) General Principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013/04 www.ibuepd.de
- DIN EN /ISO 14025:201110: Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- ISO 14040:2006 - Environmental management – Life cycle assessment – Principles and framework
- ISO 14044:2006 - Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 21930:2017 - Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services
- EN 15804:201204+A1 2013: Sustainability of construction works - Environmental Product Declarations - Core rules for the product category of construction products
- ISO 14001:2015 - Environmental management systems -- Requirements with guidance for use
- ISO 9001:2015 - Quality management systems – Requirements
- JIS G 3101: Rolled steels for general structure



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- JIG G 3106: Rolled steels for welded structure
- JIG G 3136: Rolled steels for building structure
- Notification No. 1400 by Ministry of Construction Japan: Classification of incombustible materials
- Product Category Rules for Building-Related Products and Services, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL Environment, Standard 10010, Version 3.1 December 2018
- IBU Part B: Requirements on the EPD for Structural steels Version 1.6 November 2017
- Product Category Rules for preparing an environmental product declaration for Part B: Requirements on the EPD for Structural steels (ADDENDUM, VERSION 1.1, December, 2017)
- North American Product Category Rule for Designated Steel Construction Products: SGS Services, Version 1.0. May 2015 Layout guidelines for photos:

