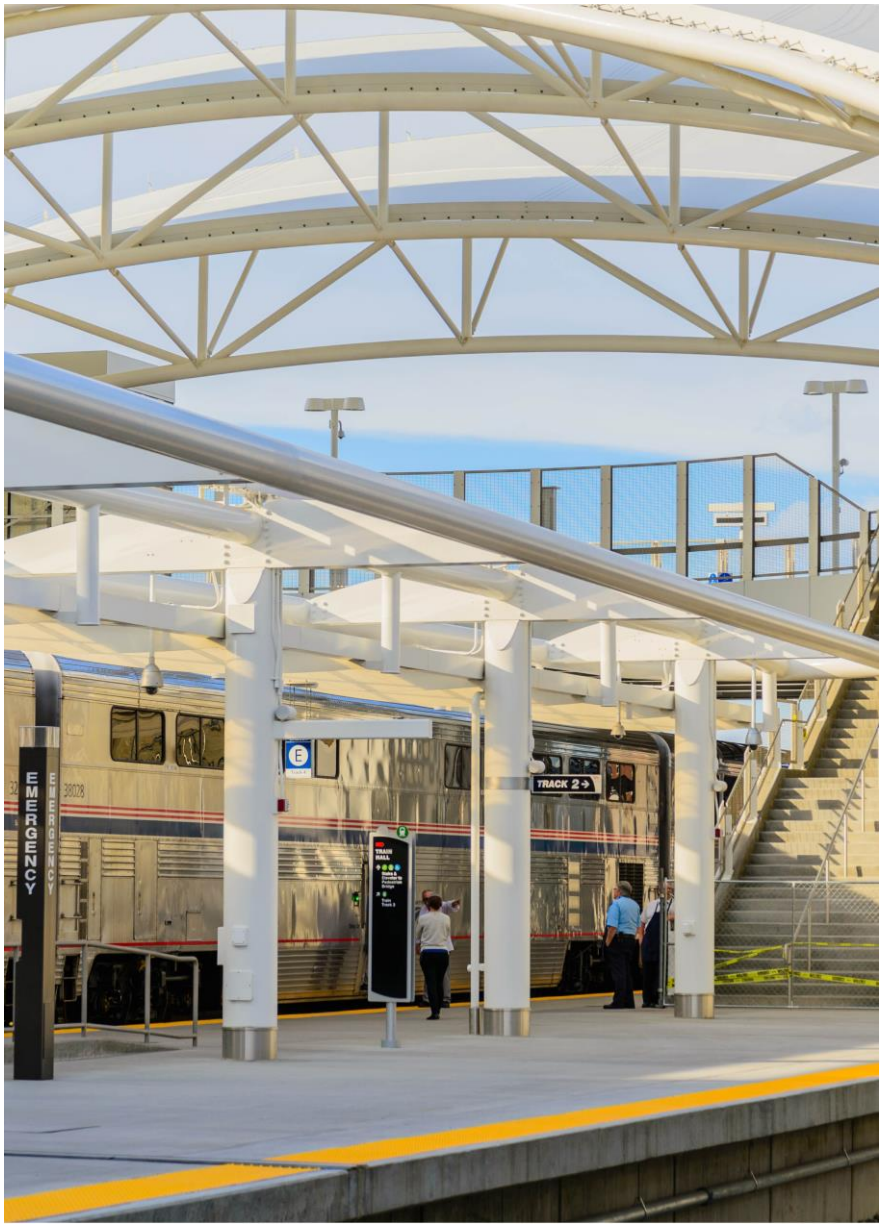
ENVIRONMENTAL PRODUCT DECLARATION

HOLLOW STRUCTURAL SECTIONS

STEEL TUBE INSTITUTE



Hollow structural sections produced in the United States by a Steel Tube Institute member.

Use of this EPD is limited to Steel Tube Institute members, including Atlas Tube; EXLTUBE; Hannibal Industries, Inc.; Independence Tube Corporation; Maruichi American Corporation; Maruichi Leavitt Pipe & Tube, LLC; Maruichi Oregon Steel Tube (MOST); Searing Industries; Southland Tube, Inc.; and Vest, Inc.

Steel Tube Institute™

The Steel Tube Institute (STI) was formed in 1930 when a group of manufacturers joined forces to promote and market steel tubing. Their goal was to mount a cooperative effort that would improve manufacturing techniques and inform customers about their products' utility and versatility. This remains the basic motivation for the Institute's efforts today. Using that strong history as a foundation, STI is constantly evolving to best meet the needs of a sophisticated and competitive marketplace. The organization is dedicated to the betterment of the steel industry and to the advancement of its member companies.

For more information, please visit: www.steeltubeinstitute.com/hss/about-us/leed-epd

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION ULCOM/EPD

ENVIRONMENTAL PRODUCT DECLARATION

Steel Tube Institute

HOLLOW STRUCTURAL SECTIONS

According to ISO 14025

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. 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, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Steel Tube Institute
DECLARATION NUMBER	4787390518.101.1
DECLARED PRODUCT	Hollow structural steel sections
REFERENCE PCR	North American PCR for Designated Steel Construction Products, v1.0, 2015
DATE OF ISSUE	September 22, 2016
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	PCR Review Panel Chair: Thomas Gloria info@SCSglobalservices.com
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Wade Stout, UL
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas P. Gloria, Industrial Ecology Consultants

HOLLOW STRUCTURAL SECTIONS

According to ISO 14025

Product Definition

Association Description

The Steel Tube Institute (STI) is a not-for-profit trade association dedicated to advancing the growth and competitiveness of North America's steel tubular products. Established in 1930, the Institute's purpose was and still is to promote the benefits of steel tube in all aspects of current and future product utilization. STI's strength is bringing together resources to move the industry forward through active collaboration. STI's primary focus is in areas that include innovations in production and manufacturing methods, exchanging technical knowledge and expertise, impacting codes and specifications, and increasing marketplace knowledge.

STI also seeks to inform specifiers, consumers and end-users about the utility and versatility of steel tube and pipe by offering educational support through seminars, presentations, publications and more. STI is constantly evolving to best meet the needs of a sophisticated and competitive marketplace. The organization is dedicated to the betterment of our industry and our member companies.

Participating Members

This environmental product declaration (EPD) represents hollow structural sections (HSS) produced by STI's membership. All members who produce HSS contributed to this EPD. Members included:

- Atlas Tube
- EXLTUBE
- Hannibal Industries, Inc.
- Independence Tube Corporation
- Maruichi American Corporation
- Maruichi Leavitt Pipe & Tube, LLC
- Maruichi Oregon Steel Tube (MOST)
- Searing Industries
- Southland Tube, Inc.
- Vest, Inc.

Product Description

Hollow structural sections covered under this declaration are cold-formed welded steel tubing produced in round, square, and rectangular shapes in a broad range of dimensions, gauges, and lengths. HSS is used for structural and miscellaneous elements in buildings, bridges and other structures as well as a variety of manufactured products such as agriculture implements and rollover or other protection structures for vehicles.

Application and Codes of Practice

Hollow structural sections are defined by the following ASTM standards:

– ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

– ASTM A513 Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

– ASTM A847 Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance

– ASTM A1085 Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS)

Additionally, the following products are produced by the manufacturers and are included in this declaration as they use the same materials and processes to manufacture:

– ASTM A252 Standard Specification for Welded and Seamless Steel Pipe Piles
– ASTM A53 Standard Specification for Pipe
– CSA G40.21 General Requirements for Rolled or Welded Structural Quality Steel

Additional information can be found on STI's website at www.steeltubeinstitute.com/hss/about-us/leed-epd.

Life Cycle Stages

The life cycle stages for hollow structural sections are summarized in the flow diagram shown in the figure below. Only the cradle-to-gate performance is considered in the analysis.

Raw Materials

Hollow structural sections are manufactured entirely from steel. They do not contain any materials or substances for which there exists a route to exposure that leads to humans or flora/fauna in the environment being exposed to said materials or substances at levels exceeding safe health thresholds. Steel production was represented by background datasets for hot-rolled coil, published by worldsteel.

Inbound Transportation

Inbound transportation distances and modes for steel and ancillary manufacturing materials (e.g., lubricants and cutting blades) were collected from each HSS manufacturer.

Manufacturing

The major input to HSS production is the hot-rolled coil itself; however small amounts of process materials are needed, such as lubricants for the machines. Energy is also needed to roll-form the steel into tubes and weld coil edges together. Metal scrap generated during manufacturing is recycled externally. Fabrication and galvanization, which typically take place after HSS production, are not included in this environmental product declaration.

Requirements for Underlying Life Cycle Assessment

A "cradle-to-gate" analysis using life cycle assessment (LCA) methodology was conducted for this EPD. The analysis was done according to the product category rule (PCR) for Designated Steel Construction Products and followed LCA principles, requirements and guidelines laid out in the ISO 14040/14044 standards. As such, EPDs of construction products may not be comparable if they do not comply with the same PCR. While the intent of the PCR is to increase comparability, there may still be differences among EPDs that comply with the same PCR (e.g., due to differences in

system boundaries, background data, etc.).

Declared unit

The declared unit for this EPD is one metric ton of steel construction product. Note that comparison of EPD results on a mass basis, alone, is insufficient and should consider the technical performance of the product.

Name	Required Unit	Optional Unit
Declared Unit	metric ton	short ton
Density	7,850 kg / m^3	490 lbs. / $ft.^3$

System Boundaries

The “cradle-to-gate” life cycle stages represent the product stage (information modules A1-A3) and include:

- A1: all extraction and processing of raw materials, any reuse of products or materials from a previous product system, processing of secondary materials, and any energy recovery or other recovery processes from secondary fuels;
- A2: all transportation to the factory gate and all internal transport;
- A3: generation of electricity from primary energy resources, including upstream processes; production of all ancillary materials, pre-products, products, and co-products, including any packaging; emissions from on-site fuel combustion.

Product Stage			Construction Stage		Use Stage					End-of-Life Stage				Benefits & Loads
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	D
			EXCLUDED FROM THIS STUDY											
Raw materials supply	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	De-construction	Transport	Waste processing	Disposal	Reuse, recovery, recycling potential

This EPD represents 2015 HSS production in the United States as produced by STI member companies.

Assumptions

Facility data represent HSS as well as steel tube made for other purposes, including pipe and piles, since all products are manufactured from the same materials via the same processes. HSS, however, represent the majority of product manufactured by the participating members.

All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production data on raw materials and processes. All of the reported material and energy flows have been accounted for.

Allocation

Allocation between structural and non-structural tube was based on product mass. Allocation of background data (energy and materials) taken from the GaBi 2016 databases is documented online at http://www.gabi-software.com/international/support/gabi/.

Cut-off Criteria

The cut-off criteria for including or excluding materials, energy and emissions data of the study are as follows:

- Mass: If a flow is less than 1% of the cumulative mass of the model it may be excluded, providing its environmental relevance is not a concern.
- Energy: If a flow is less than 1% of the cumulative energy of the model it may be excluded, providing its environmental relevance is not a concern.
- Environmental relevance: If a flow meets the above criteria for exclusion, yet is thought to potentially have a significant environmental impact, it was included.

Capital goods for the production processes (machines, buildings, etc.) were not taken into consideration.

Life Cycle Assessment Results and Analysis

Life cycle assessment results are presented per metric ton of steel product, the required reporting unit, and per short ton of steel product, the optional reporting unit. Primary energy use represents lower heating value (LHV).

Note: worldsteel life cycle inventories for steel products do not include potential environmental impacts for certain alloying elements—in particular, silico-manganese. These elements were excluded from the analysis due to lack of available data at the time the worldsteel LCIs were conducted. Thus EPDs based on worldsteel steel data cannot be compared with EPDs whose steel LCIs include the alloying elements due to differences in scope.

Use of Energy and Material Resources

Primary Energy	Results per metric ton		Results per short ton	
Use of renewable primary energy resources excluding those used as raw materials	505	MJ	4.34E+05	BTU
Use of renewable primary energy resources as raw materials	72.1	MJ	6.20E+04	BTU
Total use of renewable primary energy resources	***577***	**MJ**	***4.96E+05***	**BTU**
Use of non-renewable primary energy resources excluding those used as raw materials	24,100	MJ	2.07E+07	BTU
Use of non-renewable primary energy resources as raw materials	8.95	MJ	7.70E+03	BTU
Total use of non-renewable primary energy resources	***24,100***	**MJ**	***2.07E+07***	**BTU**

Material Resource Use	Results per metric ton		Results per short ton	
Use of secondary material	0.132	metric ton	0.132	short ton
Use of renewable secondary fuels	0	MJ	0	BTU
Use of non-renewable secondary fuels	0	MJ	0	BTU
Net use of fresh water*	*(n/a)*	m^3	*(n/a)*	gallons

* Net use of fresh water is not reported in this EPD due to lack of consistent water data in worldsteel's steel hot rolled coil dataset. worldsteel is currently working to update its data; once these data are published, net use of fresh water results can be calculated and reported.

Life Cycle Impact Assessment

Parameter	Results per metric ton		Results per short ton	
Impact Assessment Method: TRACI 2.1				
Global warming potential (GWP)	2.11E+00	metric ton CO_2 eq.	2.11E+00	short ton CO_2 eq.
Depletion potential of the stratospheric ozone layer (ODP)	2.08E-08	metric ton CFC-11 eq.	2.08E-08	short ton CFC-11 eq.
Acidification potential of soil and water (AP)	7.81E-03	metric ton SO_2 eq.	7.81E-03	short ton SO_2 eq.
Eutrophication potential (EP)	3.90E-04	metric ton N eq.	3.90E-04	short ton N eq.
Formation potential of tropospheric ozone (POCP)	1.05E-01	metric ton O_3 eq.	1.05E-01	short ton O_3 eq.
Impact Assessment Method: CML2001 (v4.1)				
Abiotic depletion potential (ADP-elements)*	8.50E-08	metric ton Sb eq.	8.50E-08	short ton Sb eq.
Abiotic depletion potential (ADP-fossil)	2.33E+04	MJ	2.00E+07	BTU

* This indicator is based on assumptions regarding current reserves estimates; therefore, caution is necessary when interpreting results because there is insufficient information on which indicator is best for assessing the depletion of abiotic resources.

Other Environmental Information

Parameter	Results per metric ton		Results per short ton	
Hazardous waste disposed*	*(n/a)*	metric ton	*(n/a)*	short ton
Non-hazardous waste disposed*	*(n/a)*	metric ton	*(n/a)*	short ton
Radioactive waste disposed	2.95E-04	metric ton	2.95E-04	short ton
Components for re-use	0	metric ton	0	short ton
Materials for recycling	0	metric ton	0	short ton
Materials for energy recovery	0	metric ton	0	short ton
Exported energy	0	MJ	0	BTU

* Hazardous and non-hazardous waste disposed are not reported in this EPD due to lack of waste inventory data in worldsteel's hot rolled coil dataset.

Visualization of Life Cycle Impact Assessment

The diagram in this section illustrates the degree to which the modules drive non-renewable energy demand and the major impact categories.

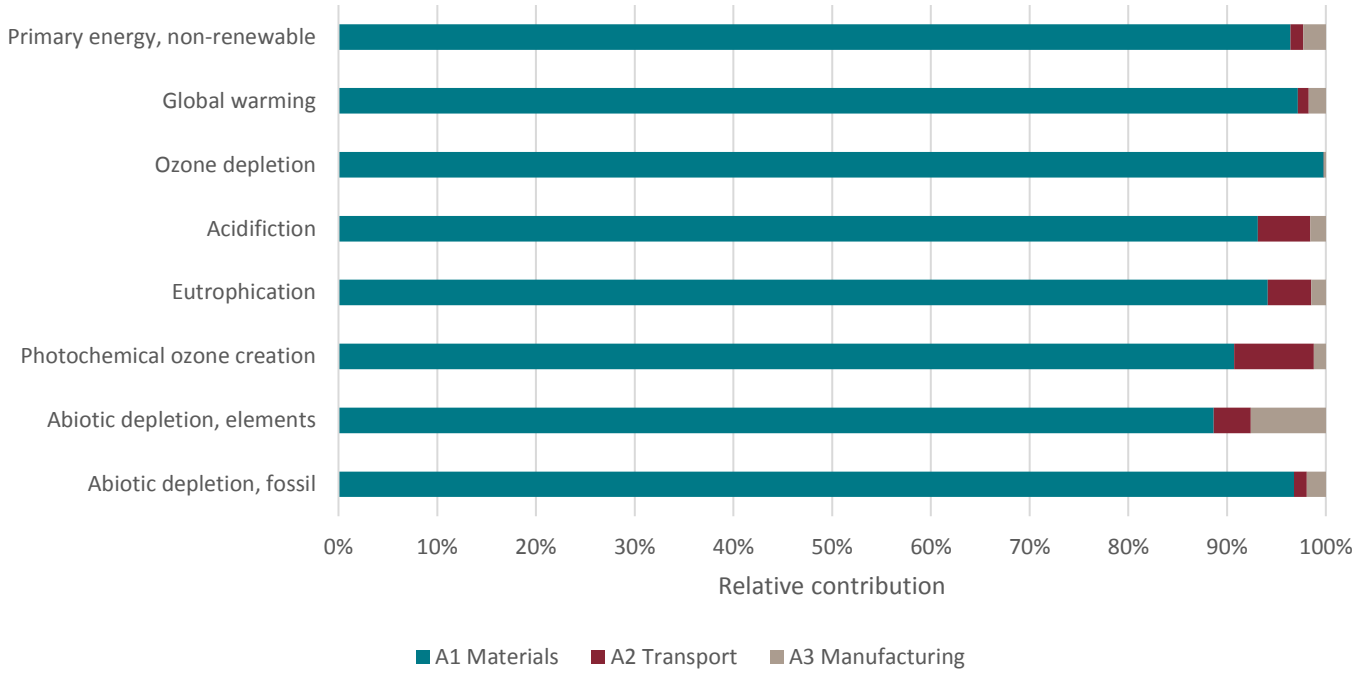


Figure 1: Relative module contribution for energy and impact assessment categories

Data Quality Assessment

Temporal representativeness: All primary data were collected for 12-consecutive months during the 2014 and 2015 calendar years. All secondary data come from the GaBi 2016 databases and are representative of the years 2007-2015. Therefore, temporal representativeness is warranted. **Geographical representativeness:** All primary and secondary data were collected specific to the countries or regions under study. Whenever country-specific background data were not readily available, U.S., European, or global data were used as proxies. Geographical representativeness is considered to be high. **Technological representativeness:** Primary data were collected for the production of HSS by STI members and represent the manufacturing technologies in use. All other major contributors to results are either representative of North America or of the technology-specific technology mix (e.g., electricity grid). Where technology-specific secondary data were unavailable, proxy data were used. Technological representativeness is considered to be high. **Precision:** As the majority of the relevant foreground data are measured data or calculated based on primary information sources of the owner of the technology, precision is considered to be high. All background data are sourced from GaBi databases with the documented precision (http://www.gabi-software.com/international/support/gabi/).

Disclaimer: This Environmental Product Declaration (EPD) conforms to ISO 14025, ISO 14040, ISO 14044, and ISO 21930.

Scope of Results Reported: The PCR requires the reporting of a limited set of LCA metrics; therefore, there may be relevant environmental impacts beyond those disclosed by this EPD. The EPD does not indicate that any environmental or social performance benchmarks are met nor thresholds exceeded.

Accuracy of Results: This EPD has been developed in accordance with the PCR applicable for the identified product following the principles, requirements and guidelines of the ISO 14040, ISO 14044, ISO 14025 and ISO 21930 standards. The results in this EPD are estimations of potential impacts. The accuracy of results in different EPDs may vary as a result of value choices, background data assumptions and quality of data collected.

Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. Such comparisons can be inaccurate, and could lead to the erroneous selection of materials or products which are higher-impact, at least in some impact categories. Any comparison of EPDs shall be subject to the requirements of ISO 21930. For comparison of EPDs which report different module scopes, such that one EPD includes Module D and the other does not, the comparison shall only be made on the basis of Modules A1, A2 and A3. Additionally, when Module D is included in the EPDs being compared, all EPDs must use the same methodology for calculation of Module D values.

Contact Information

Study Commissioner

Steel Tube Institute
2516 Waukegan Road, Suite 172
Glenview, IL 60025
+1 (847) 461-1701
http://steeltubeinstitute.org/

LCA Practitioner

thinkstep, Inc.
170 Milk St, 3rd floor
Boston, MA 02109
+1 (617) 247-4477
info@thinkstep.com
http://www.thinkstep.com