Steel plate complying with the definition of structural steel in ANSI/AISC 303-16 produced in the United States and fabricated by an AISC member fabricator.

Use of this EPD is limited to AISC members. Member names are available online at www.aisc.org/epd.

The United States structural steel industry annually supplies, fabricates and erects structural steel framing for more than 10,000 buildings, bridges and industrial projects through a network of producers, service centers, steel fabricators and erectors.

The National Steel Bridge Alliance, a division of the American Institute of Steel Construction (AISC), is a national, not-for-profit organization dedicated to advancing steel bridge design and construction. NSBA is a unified industry organization of businesses and agencies interested in the development, construction and promotion of cost-effective steel bridges. We represent the entire steel bridge community.

Long committed to the principles of sustainable manufacturing, the industry remains the world leader in the use of recycled materials and end-of-life recycling, with the recycled content of steel plate produced at US mills averaging in excess of 80% and an end-of-life recovery rate of 98%.

The American Institute of Steel Construction is a not-for-profit technical institute and trade association established in 1921 to serve the structural steel design community and construction industry. AISC currently represents 3 producers of steel plate and nearly 1,000 structural steel fabricators in the US.
AMERICAN INSTITUTE OF STEEL CONSTRUCTION
FABRICATED STEEL PLATE

According to ISO 14025 and ISO 21930:2017

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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.2.5 March 2020

ASSOCIATION NAME AND ADDRESS

American Institute of Steel Construction | 130 E Randolph Street, Suite 2000 | Chicago, IL 60601

DECLARATION NUMBER

4789556099.101.1

DECLARED PRODUCT & DECLARED UNIT

Fabricated Steel Plate, 1 metric ton

REFERENCE PCR AND VERSION NUMBER


DESCRIPTION OF PRODUCT APPLICATION/USE

Steel plate used in building, bridge, and industrial projects

MARKETS OF APPLICABILITY

North America

DATE OF ISSUE

January 1, 2021

PERIOD OF VALIDITY

5 years

EPD TYPE

Industry-average

EPD SCOPE

Cradle-to-gate

YEAR(S) OF REPORTED PRIMARY DATA

2019-2020

LCA SOFTWARE & VERSION NUMBER

GaBi v10

LCI DATABASE(S) & VERSION NUMBER

GaBi 2020 (CUP 2020.2)

LCIA METHODOLOGY & VERSION NUMBER

TRACI 2.1

---

This PCR review was conducted by:

This declaration was independently verified in accordance with ISO 14025: 2006

☐ INTERNAL  ❍ EXTERNAL

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

UL Environment

PCR Review Panel

epd@ulenvironment.com

Grant R. Martin, UL Environment

Thomas P. Gloria, Industrial Ecology Consultants

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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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General Information

Description of Organization

The American Institute of Steel Construction (AISC), headquartered in Chicago, is a not-for-profit technical institute and trade association established in 1921 to serve the structural steel design community and construction industry in the United States. AISC's mission is to make structural steel the material of choice by being the leader in structural steel related technical and market-building activities, including: specification and code development, research, education, technical assistance, quality certification, standardization, and market development. AISC has a long tradition of service to the steel construction industry providing timely and reliable information.

Participating Members

This EPD represents fabricated steel plates produced by AISC's membership. More than 75 AISC members contributed data for EPD development. Member names are available online at www.aisc.org/epd.

Product Description

Fabricated steel plates are used in building, bridge, and industrial projects. Plates are detailed, cut, drilled, bolted, welded, and otherwise processed at the fabricator to prepare them for installation.

Product Specification

Fabricated steel plate consist of a family of steel products of varying strength, performance, physical, metallurgical, and chemical characteristics meeting the requirements of the Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling (ASTM A6-19) and grade specific standards referenced therein. Structural steel, as defined in The Code of Standard Practice for Steel Buildings and Bridges (ANSI/AISC 303-16), is then fabricated according to applicable standards.

Flow Diagram

[Diagram showing the process from Steel mill product manufacturing to Steel product to customer, with steps for Resource inputs, Transport, and Manufacturing]
Product Average

The 2019 and 2020 production data used to develop this EPD consider all fabrication activities at participating AISC member companies. The fabricators are located throughout the United States. Results are weighted according to production totals at participating fabricators.

Application

Structural steel consists of the elements of the structural frame that are shown and sized in the structural design documents, essential to transfer the design loads and described in The Code of Standard Practice for Structural Steel Buildings and Bridges (ANSI/AISC 303-16).

Material Composition

Fabricated steel plate is fabricated entirely from structural steel. Note: Steel products used inside the building envelope (e.g. used in load-bearing applications present inside wall structures) do not include materials or substances which may have any potential route of exposure to humans or flora/fauna in the environment. Steel production was represented by a background dataset for North American steel plate, published by the American Iron and Steel Institute (AISI).

Methodological Framework

Declared unit

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>metric ton</td>
</tr>
<tr>
<td>Density (typical)</td>
<td>7,800</td>
<td>kg/m³</td>
</tr>
</tbody>
</table>
System Boundary

This EPD is “cradle-to-gate” in scope. The life cycle stages included in the assessment represent the product stage (modules A1-A3) and include:

<table>
<thead>
<tr>
<th>PRODUCT STAGE</th>
<th>CONSTRUCTION PROCESS STAGE</th>
<th>USE STAGE</th>
<th>END OF LIFE STAGE</th>
<th>BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material supply</td>
<td>Transport</td>
<td>Manufacturing</td>
<td>Assembly/Install</td>
<td>Use</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>MND</td>
<td>MND</td>
</tr>
</tbody>
</table>

* X = module included, MND = module not declared

Allocation

Allocation based on shop hours was used to separate the manufacturing of fabricated structural steel from that of fabricated non-structural steel.

Allocation of background data (energy and materials) taken from the GaBi 2020 databases is documented online at http://www.gabi-software.com/america/support/gabi/.

Since the EPD does not cover the end-of-life of the products, end-of-life allocation is outside the scope of the study. Metal scrap from fabrication (module A3) was balanced with the scrap demand of the raw materials module (A1) in order to calculate the net scrap input to module A1.

Under a cradle-to-gate system boundary, scrap inputs to the system are not associated with any upstream burden, and scrap produced during manufacturing is assumed to be at least the same quality as scrap inputs into steelmaking. Remelting of scrap to produce structural steel and other raw materials is accounted for within upstream datasets.

Cut-off Rules

No formal cut-off criteria were defined for this study. The system boundary was defined based on relevance to the goal of the study. For the processes within the system boundary, all available energy and material flow data have been included in the model.

Data Sources

The LCA model was created using the GaBi software system for life cycle engineering, version 10, developed by Sphera (Sphera, 2020). Background life cycle inventory data for raw materials and processes were obtained from the GaBi 2020 database (CUP 2020.2) and background data for steelmaking were provided by the American Iron and Steel Institute (AISI). Primary fabrication data were provided by AISC member companies.
Data Quality

A variety of tests and checks were performed by the LCA practitioner throughout the project to ensure high quality of the completed LCA. Checks included an extensive internal review of the project-specific LCA models developed as well as the background data used. The data quality assessment is documented in the background report.

Period Under Review

Primary data were collected for fabrication during the years 2019 and 2020. Background data for steel production were provided by AISI and represent steel production during 2017. This declaration is intended to represent fabrication in 2019.

Estimates and Assumptions

In cases where no matching life cycle inventories are available to represent a flow, proxy data were applied based on conservative assumptions regarding environmental impacts. The choice of proxy data is documented in the background report.

The fabrication data do not differentiate between fabrication of structural sections, steel plate, hollow structural sections, or non-structural steel. Therefore it was assumed that the fabrication process does not differ between these various products.

Emissions of welding gases were calculated rather than measured, in the absence of reported emissions data by the participating fabricators.

Inbound transportation distances of ancillary materials to the fabricator were assumed to be 45 miles by truck. Inbound transportation of steel is based on actual distances and modes reported by participants.

Technical Information and Scenarios

Manufacturing

The major input to the fabrication process is the structural steel itself; however small amounts of process materials are needed, such as lubricants for the machines and welding and cutting supplies (i.e., gases and electrodes). Energy is also needed to perform the manufacturing and move the materials. Metal scrap generated during manufacturing is recycled externally. Some facilities also conduct surface preparation, such as mechanical or compressed air blasting, in order to clean the surface and prepare it for coating. Galvanization typically takes place after fabrication at a different facility while paint-style coatings may be applied in the fabrication shop. Environmental impacts associated with surface preparation and the application of coating materials are not included in this EPD. The manufacturing process is illustrated in the diagram below.
Inbound Transportation
Inbound transportation distances and modes for steel were collected from each participating fabrication facility.

Disposal
End-of-life is outside of the scope of this EPD.
Environmental Indicators Derived from LCA

North American life cycle impact assessment (LCIA) results are declared using TRACI 2.1 (Bare, 2012; EPA, 2012) methodology, with the exception of GWP which is reported using the IPCC AR5 (IPCC, 2013) methodology, excluding biogenic carbon. Primary energy use represents the lower heating value (LHV) a.k.a. net calorific value (NCV).

LCIA results are relative expressions and do not predict actual impacts, the exceeding of thresholds, safety margins or risks.

### Table 2. LCIA results, per 1 metric ton

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>TOTAL</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP 100</td>
<td>kg CO₂ eq.</td>
<td>1.73E+03</td>
<td>1.59E+03</td>
<td>4.46E+01</td>
<td>9.67E+01</td>
</tr>
<tr>
<td>ODP</td>
<td>kg CFC 11 eq.</td>
<td>1.62E-09</td>
<td>-3.19E-12</td>
<td>8.67E-14</td>
<td>1.62E-09</td>
</tr>
<tr>
<td>AP</td>
<td>kg SO₂ eq.</td>
<td>3.76E+00</td>
<td>3.42E+00</td>
<td>1.83E-01</td>
<td>1.52E-01</td>
</tr>
<tr>
<td>EP</td>
<td>kg N eq.</td>
<td>1.91E-01</td>
<td>1.63E-01</td>
<td>1.64E-02</td>
<td>1.23E-02</td>
</tr>
<tr>
<td>SFP</td>
<td>kg O₃ eq.</td>
<td>5.75E+01</td>
<td>5.08E+01</td>
<td>4.44E+00</td>
<td>2.23E+00</td>
</tr>
<tr>
<td>ADP₅₀₀</td>
<td>MJ surplus</td>
<td>1.51E+03</td>
<td>1.33E+03</td>
<td>7.16E+01</td>
<td>1.04E+02</td>
</tr>
</tbody>
</table>

**Comparability:** Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted.

Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate, and could lead to erroneous selection of materials or products which are higher-impact, at least in some impact categories.

### Table 3. Resource use results, per 1 metric ton

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>TOTAL</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPRₐₑ</td>
<td>MJ LHV</td>
<td>1.32E+03</td>
<td>1.04E+03</td>
<td>6.24E+01</td>
<td>2.16E+02</td>
</tr>
<tr>
<td>RPRₗₑ</td>
<td>MJ LHV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRPₐₑ</td>
<td>MJ LHV</td>
<td>2.16E+04</td>
<td>1.94E+04</td>
<td>6.91E+02</td>
<td>1.47E+03</td>
</tr>
<tr>
<td>NRPₗₑ</td>
<td>MJ LHV</td>
<td>1.26E+01</td>
<td>-</td>
<td>-</td>
<td>1.26E+01</td>
</tr>
<tr>
<td>SM</td>
<td>kg</td>
<td>8.85E+02</td>
<td>8.84E+02</td>
<td>-</td>
<td>7.52E-01</td>
</tr>
<tr>
<td>RSF</td>
<td>MJ LHV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NRSF</td>
<td>MJ LHV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RE</td>
<td>MJ LHV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>FW</td>
<td>m³</td>
<td>1.64E+01</td>
<td>1.56E+01</td>
<td>1.81E-01</td>
<td>6.82E-01</td>
</tr>
</tbody>
</table>
Table 4. Output flows and waste categories results, per 1 metric ton

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>TOTAL</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWD</td>
<td>kg</td>
<td>3.32E-01</td>
<td>-</td>
<td>-</td>
<td>3.32E-01</td>
</tr>
<tr>
<td>NHWD</td>
<td>kg</td>
<td>9.66E+00</td>
<td>-</td>
<td>-</td>
<td>9.66E+00</td>
</tr>
<tr>
<td>HLRW</td>
<td>kg</td>
<td>1.03E-03</td>
<td>8.77E-04</td>
<td>3.16E-05</td>
<td>1.18E-04</td>
</tr>
<tr>
<td>ILLRW</td>
<td>kg</td>
<td>8.58E-01</td>
<td>7.33E-01</td>
<td>2.64E-02</td>
<td>9.85E-02</td>
</tr>
<tr>
<td>CRU</td>
<td>kg</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MR</td>
<td>kg</td>
<td>7.71E+01</td>
<td>-</td>
<td>-</td>
<td>7.71E+01</td>
</tr>
<tr>
<td>MER</td>
<td>kg</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EE</td>
<td>MJ LHV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Per the PCR, “industry average EPDs shall report information on the statistical distribution of results for all TRACI indicators”. The min and max results presented in Table 5 represent the facilities with the lowest (best) and highest (worst) impacts, respectively. Min and max facilities are calculated for each impact category. The mean and median do not take production volumes across facilities into account (i.e. it is a calculation based on each individual facility as a data point), while the weighted average presented in Table 2 is calculated via production volume weightings reported by each fabricator.

Table 5. Statistical distribution of LCIA results, per 1 metric ton

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP 100</td>
<td>kg CO₂ eq.</td>
<td>1.47E+03</td>
<td>2.01E+03</td>
<td>1.37E+00</td>
<td>1.72E+03</td>
<td>1.71E+03</td>
</tr>
<tr>
<td>ODP</td>
<td>kg CFC 11 eq.</td>
<td>-3.61E-12</td>
<td>4.41E-08</td>
<td>-1.22E+04</td>
<td>2.56E-09</td>
<td>-2.87E-12</td>
</tr>
<tr>
<td>AP</td>
<td>kg SO₂ eq.</td>
<td>3.17E+00</td>
<td>4.65E+00</td>
<td>1.47E+00</td>
<td>3.73E+00</td>
<td>3.67E+00</td>
</tr>
<tr>
<td>EP</td>
<td>kg N eq.</td>
<td>1.51E-01</td>
<td>2.78E-01</td>
<td>1.84E+00</td>
<td>1.89E-01</td>
<td>1.85E-01</td>
</tr>
<tr>
<td>SFP</td>
<td>kg O₃ eq.</td>
<td>4.71E+01</td>
<td>7.71E+01</td>
<td>1.64E+00</td>
<td>5.66E+01</td>
<td>5.58E+01</td>
</tr>
<tr>
<td>ADP&lt;sub&gt;fossil&lt;/sub&gt;</td>
<td>MJ surplus</td>
<td>1.24E+03</td>
<td>1.93E+03</td>
<td>1.56E+00</td>
<td>1.50E+03</td>
<td>1.50E+03</td>
</tr>
</tbody>
</table>

* ODP has limited relevance due to the absence of ozone-depleting emissions in the LCI, particularly in the foreground system. Use of region-specific electricity grid mix datasets for each fabricator, therefore contributes to order of magnitude differences between ODP results for participating facilities.
Visualization of Life Cycle Impact Assessment

The relative contribution of each life cycle stage to the overall cradle-to-gate impact are presented in Figure 1, while the contribution of fabrication process components to A3 impacts are presented in Figure 2.

**Figure 1: Relative contribution by life cycle stage for 1 metric ton of fabricated structural steel plate**

**Figure 2: Relative contribution of fabrication components for 1 metric ton of fabricated structural steel plate**

**Interpretation**

Upstream steel manufacturing (A1) is the primary contributor across all indicators. Inbound transportation of steel to the fabricator (A2) and fabrication (A3) also contribute to potential environmental impacts, but on a smaller order of magnitude.

Within the fabrication process (A3), energy use, in particular electricity use, is the dominant contributor across indicators. Welding electrodes and gases are also relevant contributors. In addition, combustion of welding gases and fuels for onsite transportation contribute to GWP.
**Additional Environmental Information**

**Environment and Health During Manufacturing**

Environmental, occupational health and safety practices are in accordance with OSHA and individual state requirements.

**Environment and Health During Installation**

During installation and use, fabricated hot-rolled structural steel sections do not adversely impact human health or release emissions to indoor air. In addition, no environmental impacts to water, air or soil are expected during the product lifetime. The product does not contain any hazardous substances according to the Resource Conservation and Recovery Act (RCRA), Subtitle 3.

**Further Information**

Additional information regarding the sustainable attributes of fabricated hot-rolled sections can be found at www.aisc.org/sustainability. Information regarding this EPD is available at www.aisc.org/epd.

**References**


**Additional Environmental Information**

**Environment and Health During Manufacturing**

Environmental, occupational health and safety practices are in accordance with OSHA and individual state requirements.

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During installation and use, fabricated hot-rolled structural steel sections do not adversely impact human health or release emissions to indoor air. In addition, no environmental impacts to water, air or soil are expected during the product lifetime. The product does not contain any hazardous substances according to the Resource Conservation and Recovery Act (RCRA), Subtitle 3.

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**References**


Environment
Contact Information

Study Commissioner

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