Environmental Product Declaration

ECO EPD 00000815

In accordance with ISO 14025 and EN 15804 for:

[*Steel Profiles*]

[*Aceros AZA S.A.*]

Programme:	The International EPD® System www.environdec.com
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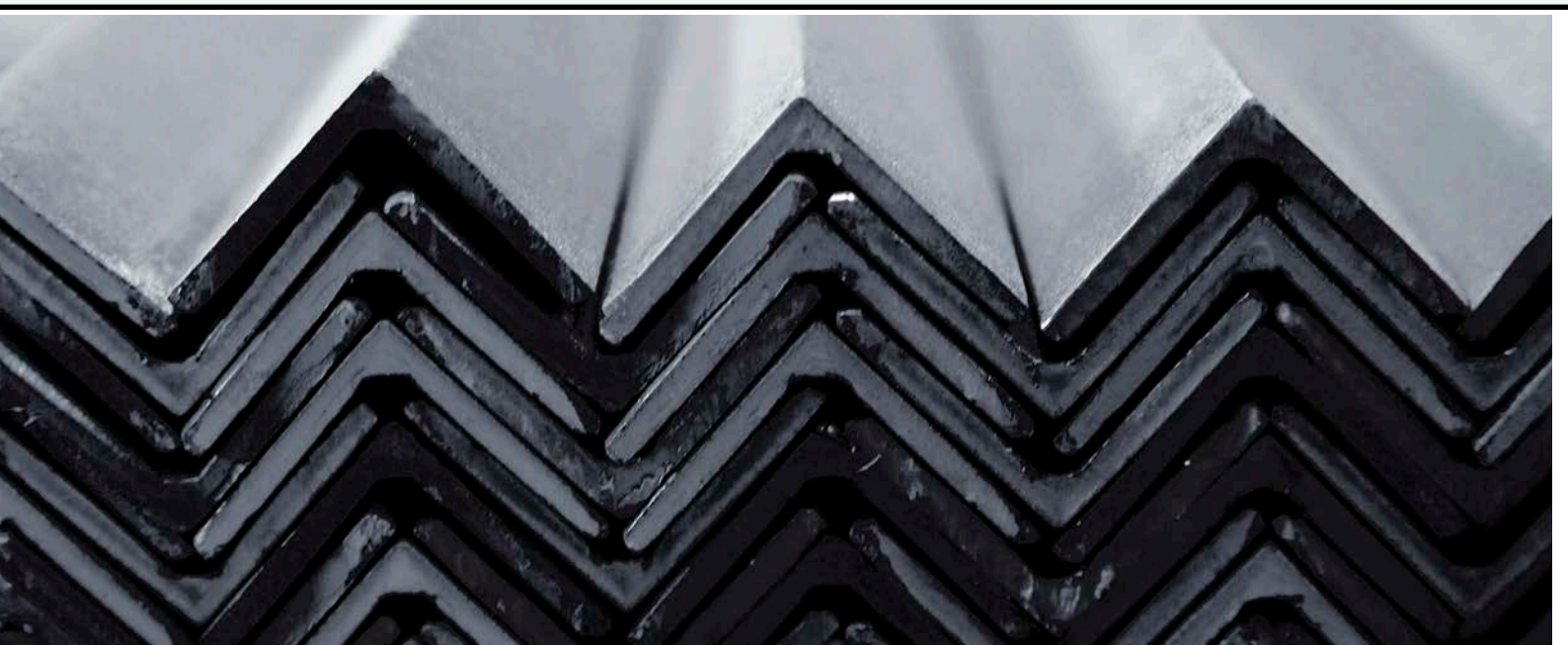


Company

In Chile AZA is the leading producer of steel from scrap. It produces long steel products such as reinforcement bars, merchant bars and wire rod. It has an installed capacity of 520 000 t of melted steel per year. In 2015 it produced 326 310 t of finished products. Its main customers are distributors of building materials in the domestic market. AZA is the only company in Chile that produces steel through a "semi-integrated'' process in which ferrous scrap is used as raw material, recycling it in an electric arc furnace. This procedure is an alternative to the "integrated process" in which iron ore is mixed with carbon, oxygen and lime in a furnace to produce steel.

AZA in Chile currently has two production plants located in different industrial sectors of Santiago. The largest one located in Colina has a production capacity of 420 000 tons of rolled steel per year; the other plant located in Renca, also produces rolled steel and has a capacity of 100 000 tons per year.

The Colina plant includes processes for the collection and preparation of scrap (grinding), as well as the smelting of scrap by electric arc furnace, the refining through a spoon furnace and the steel casting process for the production of steel ingots called billets. This plant also has a rolling mill for heating the billets and moulding them to generate reinforcement bars, wire rod and a type of steel profile called round bars. On the other hand, the Renca plant has only one laminator, which produces mainly steel profiles and in smaller quantity reinforcement bars. Since this plant does not have steelworks, requires that the billets be supplied from the Colina plant. The billets are transported by truck, covering a distance of approximately 19 km.

The company´s recycling centers are located (in addition to Santiago) in the major cities of the country such as Antofagasta, Concepción and Temuco, where the scrap is collected and sent to the Plants in Santiago.

AZA's business has been intrinsically linked to sustainability since its inception, being a fundamental pillar of its strategic focus. In this way, AZA has been focused on developing the environmental performance of its products as an attribute.

This EPD is intended to be used by diverse actors in the construction industry. It is meant to provide the information needed in the LCA of buildings and structures, which includes rebar fabricated by AZA. Another reason is to make a contribution to those buildings trying to achieve credits for the LEED® v4 Certification. With this EPD, AZA aims to communicate its environmental impacts in a fully transparent and comprehensive way, giving consumers the possibility to compare its performance with other products. This information shall be accessible to any market participants. The complete supporting information of this EPD is presented in the AZA LCA report.

Product:

Steel Profiles

This EPD refers to steel profiles manufactured in Chile by AZA, covering a variety of products of different shapes and sizes.

The UN CPC codes applied are:

- 41241: Bars and rods, hot rolled in irregularly wound coils of iron and non-alloy steel
- 41242: Other bars and rods of iron or non-alloy steel, not further worked than forged, hot rolled, hot drawn or extruded, but including those twisted after rolling
- 41264: Bars and rods, cold formed or cold finished of alloy steel

Function of the Product System

The function of the system is to make steel products for construction. This is accomplished by melting the steel in an electric arc furnace to produce billets, which are then subjected to the hot rolling process.

Description of the product:

Steel profiles of different shapes and sizes (angles, squares, etc.) provide quality and aesthetic finishes for buildings and other structures. The use of steel products in the construction industry contributes to a more sustainable environment because they are made from a highly recyclable material.

In addition, the versatility of the AZA steel profiles allows them to be used in a wide range of applications in urban and domestic life, as well as in various industrial sectors.

Declared Unit

The declared unit (DU) is 1 ton of steel profile ready for distribution.

Types of Steel Profiles:

- Saferrock:

Saferrock is a type of profiles used in the fortification and reinforcement of rocks, slopes and soils. These allow maintaining the integrity of the rock under stress, so that they act effectively, either as an arch or beam stretched through the excavation. It also fixes any loose rock or thin layer on the surface of the cavity, anchoring them deeply.

Figure. 1 Saferock profile (GERDAU 2015).

- Angle Profiles:

These profiles are used in the construction of light and heavy metal structures, where the parts are welded or bolted together, and are able to withstand dynamic stresses. Examples of application are high voltage towers, articulated structural elements in architectural use, stereometric plates, cranes, bodywork, parts of railroad cars, etc. They are also used in furniture and other minor applications.

Figure 2. Angle profile (GERDAU 2015).

- Star-shaped Profiles:

The star-shaped profiles are used for manufacturing locksmith structures, such as metal protections, grilles, gates and all work related to metalworking. They can be applied together with meshes, bars, rods or angle profiles. Their four grooved facesare excellent platforms for fixing other products, making best quality construction terminations.

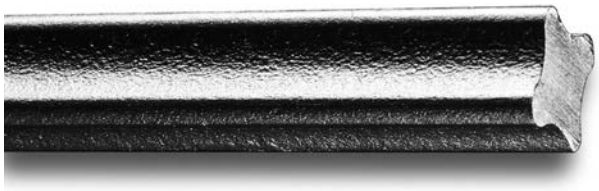


Figure 3. Star profile (GERDAU 2015).

- Flat Bars:

Flat bars are steel profiles used in the manufacture of safety rails, jaws and presses for cable clamps, parts and machine parts, welded or bolted ties to metal structures, grilles, furniture, etc.

Figure 5. Flat bars (GERDAU 2015).

- Round Bars:

The round bars are used in the manufacture of safety rails, tensioners, bolts, nuts, screws, rivets, chains, clamps, electrical hardware and industrial uses. Depending on the grade of the steel, parts or elements made of rounds can be welded without special procedures if the equivalent coal (Ceq) is less than 0.48%.

SAE 1020 grade: they can be used for the construction of small pieces and simple shapes, for later to be cemented and water tempered.

SAE 1045 grade: these types of profiles can be used in pins, clamps, bolts, agricultural tools, tongs, drawing and / or technical processing.

Figure 5. Round bars(GERDAU 2015).

- *Square Bars:*

They can be used in the manufacture of safety rails, rail nails, gratings, furniture, building structures, machine parts, etc.

Figure 6. Square bars (GERDAU 2015).

- *Hex Bars:*

Hexagonal bars are used in the manufacture of hand tools, connection elements, mining rods, punches, etc.

Figure 7. Hex bars (GERDAU 2015).

This declaration includes all the steel profile types produced by AZA in Chile listed above.

Content declaration

Standards and Quality Standards

AZA profiles are certified under the Chilean standards. NCh 204:2006; NCh: 203:2006 and NCh 697:1974, and they have a chemical composition in compliance with national regulation.

EPD reference products have a chemical composition in compliance with national regulation. All AZA production is destined for the national market.

AZA hires the services of a state-recognized materials testing agency (Idiem) for the control and certification of 100% of steel products.

Methodology

The LCA of the steel profiles is done with a cradle-to-gate scope.

LCA was conducted according to ISO 14040-14044, ISO 14025, EN 15804 and the PCR 2012:01 version 2.01 "Construction Products and Construction Services."

The production of the steel profiles only differs in the final stage, in which they are given their individual shape. Given that the impacts of this last stage correspond to less than 1% of the total impacts associated to the production phase, the same life cycle impacts were considered for all the profiles.

Allocations

Mass allocations were used following the indications of the PCR, to distribute the environmental burden between the two main product categories of AZA, the reinforcing bars and the steel profiles. Economic allocations were used in the sensitivity analysis of the results. The differences on the environmental impact indicators calculated using economic allocations were only about 1% with respect to the impact calculated using mass allocations.

The contributions of the two production plants of AZA in Santiago to the life cycle impacts of the products were distributed according to the annual mass production by each plant; i.e. the weighted average distribution of the impacts.

Cut-off criteria:

Cut-off rules were applied according to the PCR requirements; that is, 95% of all flows of the core process were included. Wastewater are the only flows which have not been considered due to the lack of reliable data. However, calculations with SimaPro 8.0 showed that their contribution to the overall life-cycle impact of the product was less than 1%.

Data and data collection

Primary data: data was taken directly from the process information at AZA's two productive Plants in Santiago, corresponding to the year 2014.

In order to complete the information, specific questionnaires were developed and interviews were conducted with the managers and professionals in the environmental area, as well as with plant and operations managers.

Secondary data: Electricity data and water-related processes related to transport and raw materials were obtained from national official sources such as the Ministries of Energy, Environment and Transport. Also some generic data, especially those related to mining processes were obtained from commercial databases available in SimaPro 8.0 (mainly Ecoinvent).

System boundaries

The life-cycle included are:

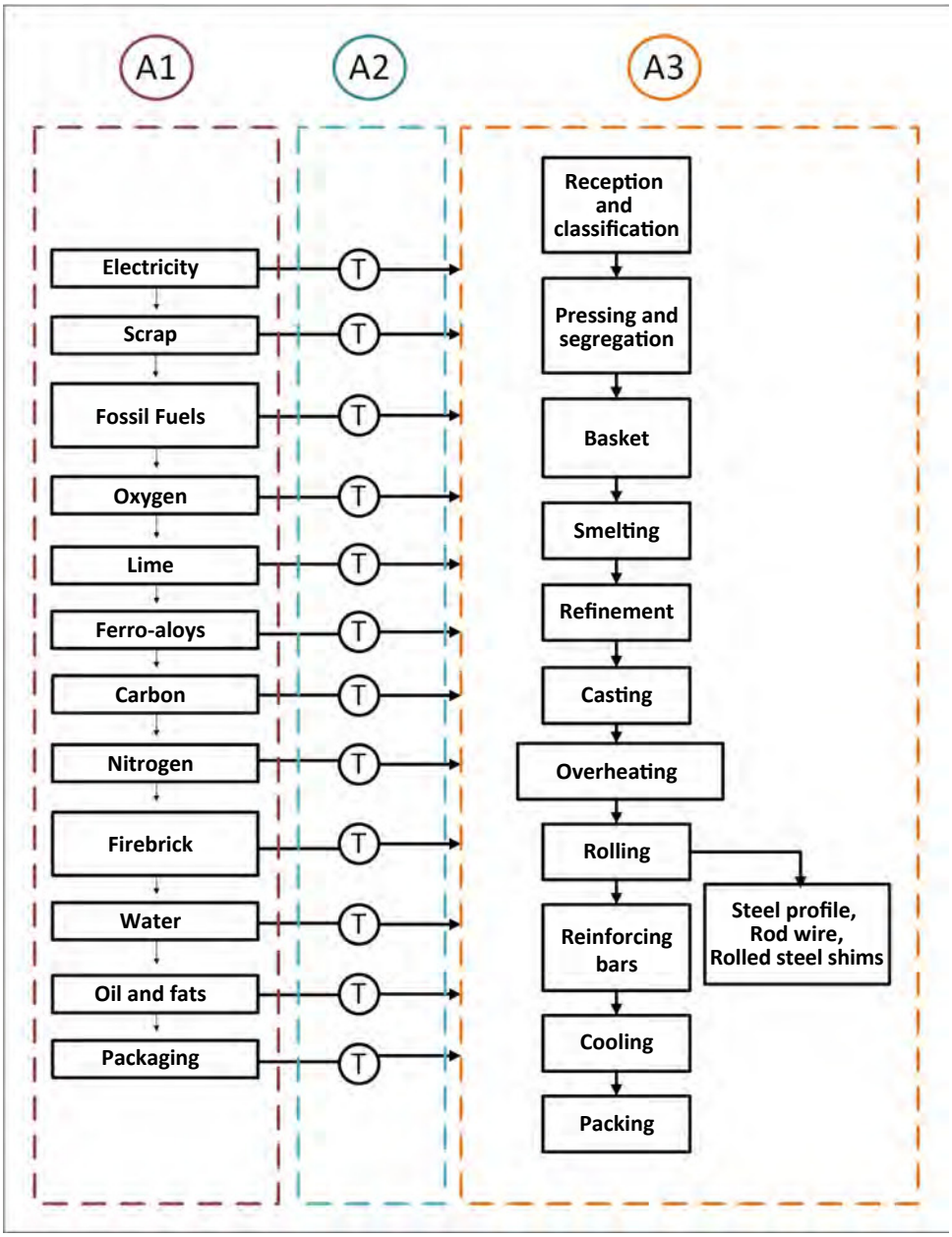
- supply of raw materials (A1): extraction and processing of raw materials, and the energy generation;
- transport of raw material (A2): external transport of raw materials to the plants and internal transport;
- product manufacturing (A3): production processes.

In accordance with the EN15804 standard, the phases of use and end of life were not considered, as shown in the following scheme:

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	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

X: declared; MND: mode not declared

Flow diagram of the product system:



Environmental performance

The LCA results are included according to the requirements of PCR 2012:01 v2.0 for the two product stages considered in this EPD: upstream and core phases (A1, A2-A3).

Resource use indicators:

The following indicators describe the use of renewable and non-renewable primary energy, and water.

		UPSTREAM		CORE	
Material and Energy	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Total use of non-renewable primary energy	MJ/DU	11 113	1 322	164	12 599
Use of non-renewable secondary fuels	MJ/DU	2 868	944	-	3 813

Table 1: Non-renewable resources used per DU.

		UPSTREAM	CORE		
Material and Energy	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Total use of renewable primary energy	MJ/DU	1 615	16	6	1 637
Use of renewable secondary fuels	MJ/DU	-	-	-	-
Steel scrap	t/DU	1.2	-	-	1.2

Table 2: Renewable resources used per DU.

Net water used	Direct use in the core process	0.5 m^3/DU

Table 3. Water use per DU.

The water consumption indicator includes also the residual water, which is later used for irrigation.

Limitations: the total water used is not included in full due to the lack of reliable upstream data regarding water accountability in the LCA; water use and water consumption are used interchangeably in many studies.

Potential environmental impact:

The estimated impact results are only relative statements, which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

The environmental impact categories are presented according to the PCR requirements.

The following potential environmental impact indicators were calculated using the CML IA model of SimaPro 8.0.

		UPSTREAM	CORE		
Impact Categories	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Global warming potential **GWP**(100)	kg CO_2eq	482	82	256	820
	(%)	59%	10%	31%	100%
Ozone depletion **ODP**	kg CFC-11 eq	5.7E-05	1.5E-05	1.5 -06	7.3E-05
	(%)	77%	21%	2%	100%
Acidification **AC**	kg SO_2eq	3.1	0.5	0.3	3.8
	(%)	81%	12%	7%	100%
Eutrophication **EU**	Kg PO_4^{-3}eq	0.8	1.0E-01	9.5E-02	1.0
	(%)	79%	11%	10%	100%
Photochemical oxidant creation **PO**	kg C_2H_4eq	1.2	0.0	0.0	1.2
	(%)	96%	1%	3%	100%
Depletion of abiotic resources (elements) **Ade**	Kg Sb eq	2.2E-04	2.2E-04	1.1E-05	4.5E-04
	(%)	49%	49%	2%	100%
Depletion of abiotic resources (fossil) **ADf**	MJ	10 994	1 301	159	12 454
	(%)	88%	11%	1%	100%

Table 4. Potential environmental impacts per DU.
Calculations made using CML IA model of SimaPro version 8.0

Other environmental indicators

The recyclability potential of steel products including steel profiles: 90% (UNEP IRP 2011).

The indicators presented in tables 5, 6 and 7 describe respectively, the waste production, the generation of residues and the air emissions, related to the declared unit.

		UPSTREAM	CORE		
Waste	**Unit**	**Raw Materials A1**	**Transport A2**	**Manufacturing A3**	**Total**
Hazardous waste	kg/DU	4.2E-03	7.8E-04	1.8E-04	5.1E-03
Non-hazardous waste	kg/DU	39.8	60.2	245.5	345.5
Radioactive waste	kg/DU	3.0E-02	9.1E-03	8.1E-04	4.0E-02

Table 5. Waste production per DU.

Residues	t/DU
Wood	3.3E-04
Cardboard	2.2E-05
Big bags	9.6E-05
Slag	1.6E-01
Dust	4.1E-02
Liquid waste sludge (Treatment Plant)	1.4E-03
Contaminated garbage	3.8E-04
Mixed liquids	1.4E-04
Organic matter (For Composting)	2.4E-04
Firebrick	1.6E-03

Table 6: Residues generated in the steelmaking process per DU.
These materials are subsequently treated or recycled through specialized external services.

Air emissions	t/DU
NOx	2.3E -03
PM	8.0E -04

Table 7. Air emissions per DU.

Additional environmental information

AZA has a long tradition in recycling steel scrap from construction and also from other industrial sectors. The principal source of raw materials is ferrous scrap generated mainly by steel consumer goods in their end-of-life phase. There are well-established systems in Chile to recover such materials, and AZA in particular is quite effective in applying logistic and management procedures to recover a significant amount of the ferrous scrap generated in the country for subsequent processing according to international good practices regarding social and environmental responsibility.

AZA carefully sorts and selects recycling materials to efficiently manufacture different steel products under the high quality requirements on physical and mechanical parameters established by national regulations.

One of steel's major benefits is that it can be completely recycled or reused at the end of the building's life. Given the value of scrap steel and that it is easily retrieved from almost any waste stream using

magnetic separation, the incentive to recover and recycle steel products is high and it proves to be more cost-effective than paying for them to be placed in landfills.

Additional information that fully complies with the Global Reporting Initiative[1] standards regarding AZA's production and its sustainable performance can be found in the CSR Annual Report[2].

[1] www.globalreporting.org
[2] www.gerdau.cl/sostenibilidad/reportes-de-sostenibilidad

General information

This declaration has been made according to General Program Instruction vrs. 2.5 (2015) of the International EPD® System. All information available at: www.environdec.com.

CEN standard EN 15804 served as the core PCR 2012:01 Construction Products and Construction Services. This EPD meets the requirements for compliance with ISO 14025 and EN15804.

Programme-related information and verification

See PCR for detailed requirements.

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com; www.epd-americalatina.com
EPD registration number:	S-P- 00697
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Product Category Rules:	PCR 2012:01 Version 2.01 (2016-03-09)
Product group classification:	UN CPC 4126 drawn and folded products of iron or steel
Reference year for data:	2014
Geographical scope:	Chile

Product category rules (PCR): CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES PRODUCT GROUP CLASSIFICATION: MULTIPLE UN CPC CODES 2012:01. VERSION 2.01. VALID UNTIL: 2018-03-03
PCR review was conducted by: The Technical Committee of the International EPD® System. Chair: Massimo Marino. IVL Swedish Environmental Research Institute. Moderator: Martin Erlandsson
Independent verification of the declaration and data according to ISO 14025:2006: ☐ EPD Process Certification (internal) ■ EPD Verification (external)
Third party verifier: *Alejandro Pablo Arena* Accredited by: *Approved by the International EPD System*

Mandatory statements

- This is a cradle to gate declaration made according to the General Program Instruction of the International EPD System.
- The product system and results were organized according to the life cycle stages described in the PCR 2012.01 v2.0 “Construction Products and Construction Services: Upstream (raw material supply, A1; transport, A2) and Core Process (manufacturing, A3).
- This declaration complies also with the EN 15804 of the EPD (for construction product EPDs).
- The use and end of life phases were not considered according to EN15804 for construction products.

EPDs within the same product category but from different programmes may not be comparable. Besides, EPDs of construction products may not be comparable if they do not comply with EN 15804, or if they are produced using different product category rules.

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ISO14044: 2006 Environmental management - Life cycle assessment - Requirements and guidelines

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