AHMSA ALTOS HORNOS DE MEXICO

LATIN AMERICA EPD®

Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 14804:2012

Hot rolled structural shapes

Programme:	**The International EPD® System www.environdec.com**
EPD registered through the fully aligned regional programme/hub:	**EPD Latin America, www.epd-latinamerica.com**
Programme operator:	**EPD International AB**
Regional Hub:	**EPD Latin America**
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Geographical scope:	**Mexico**

EPD Content

Altos Hornos de México (AHMSA) is the largest integrated steelworks in the country. Its corporate offices are in central region of the State of Coahuila, in the city of Monclova, 250 kilometers from the U.S. border.

AHMSA operates a vast industrial chain, from the extraction of iron ore and coal to the manufacturing of various steels. AHMSA has two steel plants in the city of Monclova, which cover an area of 3 000 hectares.

AHMSA currently produces approximately 5 million metric tons of liquid steel annually, and has a workforce of 19 000 employees, including its mining subsidiaries.

AHMSA is a national leader in production and marketing of steel flat products: hot rolled coil, wide plate in coils or sheets, cold rolled coil, tinplate and tin-free steel. Furthermore, it has production lines for structural shapes for the construction industry.

AHMSA supplies plate and hot rolled strip in different grades and specifications for various applications in the automotive and construction industries. These products are also used to manufacture heavy machinery, tubing, structures and pressure vessels, among others. AHMSA is the only steel wide plate manufacturer in the country, also it is the only producer of tin-free steel and the main producer of tinplate and largest structural shapes manufacturer in Mexico.

AHMSA manages, collects and operates waste disposal through pro-cleaning patronage in municipalities of the State of Coahuila (Monclova, Frontera, Castaños, San Buenaventura and Nadadores). Sanitary landfill is operated by AHMSA which has 50 Ha and AHMSA has donated equipment to this sanitary landfill.

AHMSA operates the wastewater treatment plant of the city, which treats 640 liters per second. Treated water is supplied to AHMSA's process, in order to decrease water extraction.

AHMSA and the Government of the State of Coahuila as part of the culture and social recreation programme.

This Environmental Product Declaration (EPD) is in accordance with ISO 14025 and EN 15804, for hot rolled structural shapes.

EPD of constructions products may not be comparable if they do not comply with EN 15804 Sustainability of constructions works – Environmental product declarations – Core rules for product category of construction products.

Environmental product declarations within the same product category from different programs may not be comparable.

2. General information

Product:	Hot rolled structural shapes
Declaration owner:	Altos Hornos de México S.A.B. de C.V. Prolongación Juárez S/N, Col. La Loma. Monclova, Coahuila, México. C.P. 25770. Contact person: Oscar Abrego Rodriguez. oabregor@gan.com.mx
Description of the construction product:	Structural steel is of different shapes: "W" shapes, "C" shapes and angles "L" shapes.
Declared Unit:	1 metric ton of hot rolled structural shapes
Construction product identification:	Central Product Classification: CPC 4125 Angles, shapes and sections, not further worked than hot-rolled, hot-drawn or extruded, of iron or non-alloy steel; sheet piling of steel; welded angles, shapes and sections, of steel; railway or tramway track construction material of steel
Description of the main product components and or materials:	Low, medium and high carbon steel.
Life cycle stages not considered:	Distribution, use, end of life.
Content of the declaration:	This EPD is based on information modules that do not cover the aspects of use and end of life of the product. It contains in detail, for modules A1, A2 and A3: •Product definition and physical data. •Information about raw materials and origin. •Specifications on manufacturing the product. •Notes on product processing. •LCA based on a declared unit, cradle-to-gate. •LCA results. •Evidence and verifications.
For more information consult:	www.ahmsa.com
Site for which this EPD is representative:	Manufacturing Plant: Prolongación Juárez S/N, Col. La Loma. Monclova, Coahuila, México. C.P. 25770
Public intended:	B2B (Business to Business)

3. Product description

AHMSA offers profiles of hot rolled steel: beam, wide skid profiles; angle, profiles of equal and unequal skids; channel, profiles with variable skate inner surface for various applications in the construction industry.

AHMSA manufactures “W” shapes, “C” shapes, and “L” shapes (angles) and offers a wide range of product. For more details about dimensions and properties of structural shapes, visit www.ahmsa.com.

Uses

- Minig industry.
- Distribution.
- Construction.

3.1. Technical specifications

Specifications of hot rolled structural shapes are shown in Table 1 and Table 2 shows chemical composition and mechanical properties of structural shapes.

Table 1. Hot rolled structural shapes specifications	
Specification	Description & Aplication
ASTM A-6	General specification to dimensions and tolerances
AISC	Design specifications and properties
A-36/A-572-50	Dual grade to high-strength low-alloy structural steel
ASTM A-992	Low-carbon structural steel

Table 2. Chemical composition and mechanical properties of structural shapes											
	Chemical composition, % weight (maximun)										
Norm	C	Mn	P	S	Si	Nb	V	Elastic limit (KSI)	Stress resistance (KSI)	% elong. in 8"	a% elong. in 2"
ASTM A-36 / A-572-50	0.22	0.50-1.20	0.035	0.040	0.40	0.005-0.05	0.005-0.05	50	65-80	20	23
ASTM A-572-50	0.23	1.35	0.04	0.05	0.40	0.005-0.05	0.005-0.05	50	65	18	21
ASTM A-992	0.23	0.50-1.60	0.035	0.045	0.40	0.05	---	50-65	65	18	21

4. Content declaration

Hot rolled structural shapes manufactured by AHMSA are made of 100% low alloyed steel manufactured with iron ore and 80% of recycled material. The composition of the low alloyed is shown in Table 3

Components	% Weight
Iron (Fe)	98.47- 97.86
Carbon (C)	0.23
Manganese (Mn)	0.78 - 1.38
Phosphorus (P)	0.04
Sulpur (S)	0.045
Silicon (Si)	0.4
Niobium (Nb)	0.02
Vanadium (V)	0.028 - 0.05

Table 3. Composition of hot rolled structural shapes by AHMSA

5. LCA Rules

Environmental potential impacts were calculated according to EN 15804:2012 and PCR 2012:01 Construction products and construction services Version 2.2 (2017-05-30). This EPD is in accordance with ISO 14025:2006.

Environmental potential impacts were calculated through Life Cycle Assessment (LCA) methodology according to ISO 14040:2006 and ISO 14044:2006. An external third-party critical review process of the LCA was conducted according to ISO/TS 14071:2014.

5.1. Declared unit

One metric ton of hot rolled structural shapes.

5.2. System boundary

This is a cradle to gate EPD. The following life cycle stages were considered:
A1 – Raw materials supply.
A2 – Transport.
A3 – Manufacturing.
Description of the system boundary is presented in Table 4.

Life cycle environmental information of hot rolled structural shapes							Other environmental information
Product stage			**Construction process stage**		**Use stage**	**End of life stage**	**Reuse recovery stage**
A1	A2	A3	A4	A5	B1 - B7	C1 - C4	D
Raw materials supply	Transport	Manufacturing	Transport	Construction installation	Use Maintenance Repair Replacement Refurbishment Operational energy use Operational water use	De-construction demolition Transport Waste processing Disposal	Reuse – recovery – recycling potential
X	X	X	MND	MND	MND	MND	MND

(X = included in LCA; MND = Module Not Declared)

Table 4. Hot rolled structural shapes manufactured by AHMSA product system

A1) Raw materials supply	A2) Transportation	A3) Manufacturing
Raw materials production: coal, iron ore, iron pellets, sinter, coke, fluxes, ferroalloys, briquette.	Raw materials transportation.	Water consumption.
Generation and distribution of national electricity.	Auxiliary materials transportation.	Production and consumption of auxiliary materials: oxygen, nitrogen, textiles for cleaning and maintenance, lubricating oils.
AHMSA's electricity generation and distribution.	Packaging materials transportation.	Waste generation and waste management processes.
Extraction and distribution of fuels.	Fuels transportation.	Air emissions.
	Internal transportation requirements	Wastewater generation.
		Transport of waste to the treatment and final disposal site.

Table 5. Description of information modules included in this EPD.

5.3. Description of the manufacturing process

Steel production process is shown in Figure 1.

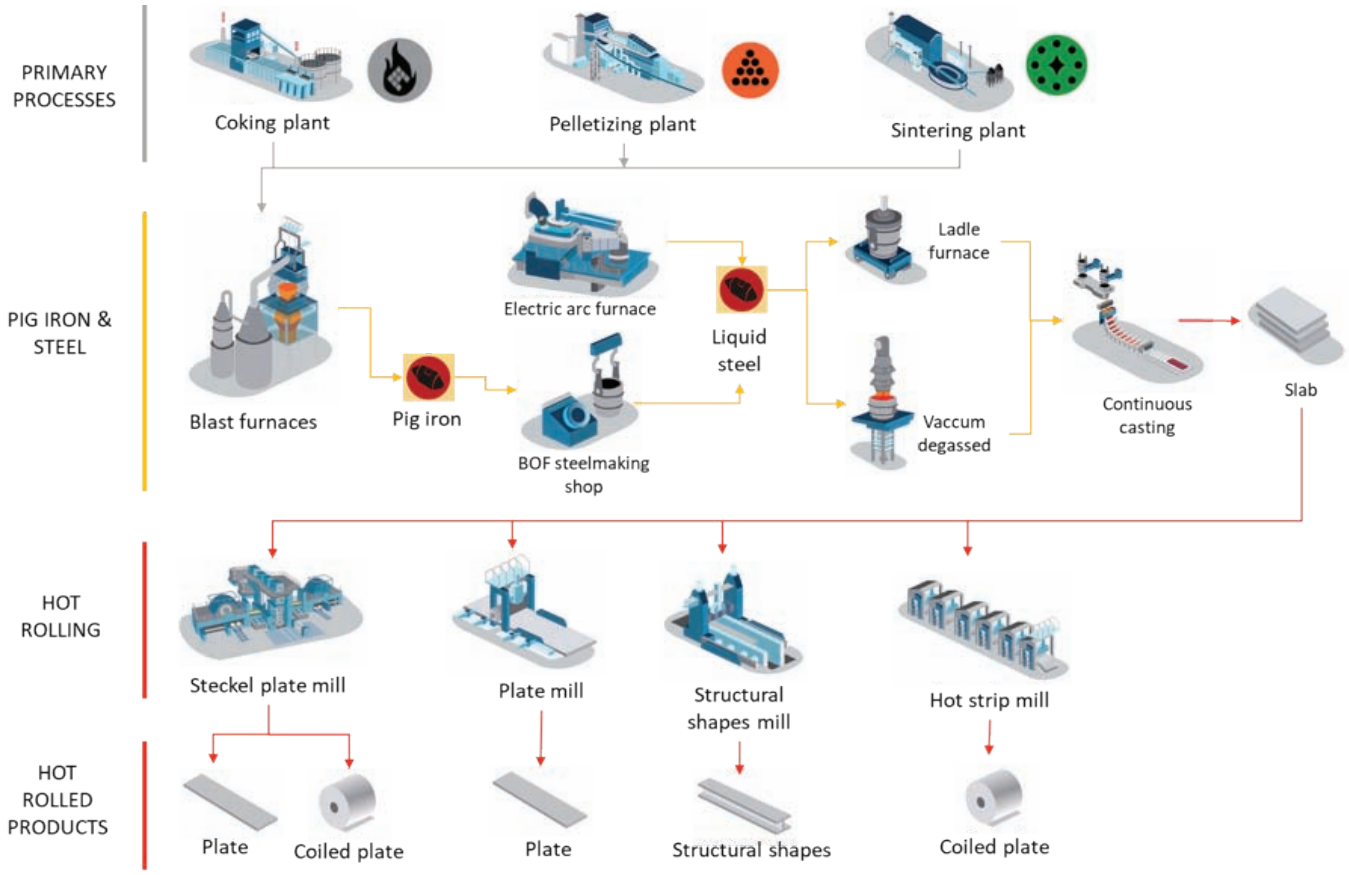

Figure. 1. Flow diagram of hot rolled structural shapes manufacturing process

5.4. Assumptions

- Distance of internal terrestrial transportation is 10 km.
- Transportation distance of textiles for cleaning and oil for maintenance is 14.2 km.
- Textiles for cleaning and maintenance absorb 55% of its weight, once it meets the oil.
- Textiles for cleaning and maintenance and lubricating oils are hazardous waste at the end of process.
- Transportation of coke gas and blast furnace gas is by pipeline.
- Transportation distance of oxygen, nitrogen and argon is 10 km.

5.5. Cut-off criteria

A minimum of 95% of the total flows (matter and energy) in modules A1 and A3 modules were included. Company infrastructure, employee's transportation and administrative activities were kept out of the scope of this study.

5.6. Allocation

Allocation of inputs and outputs of the system between product and coproducts was based on a mass relation, considering the quantity produced per year of each product and coproduct at the level of unit process.

Table 6 shows the coproducts generated during hot rolled structural shapes manufacturing.

Unit process	Coproduct
Coking plant	Coke gas
Sinter plant	Scrap
Blast furnace	Slag
Electric arc	Blas furnace gas
furnace	Slag
Hot rolling	Scrap

Table 6. Coproduct generated in hot rolled structural shapes manufacturing

The polluter pays principle was applied for the allocation procedure during recycling. In this way, in each case when there was an input of secondary material to the hot rolled structural shapes product system, recycling process and transportation to the site were included in life cycle inventory (for example, steel scrap). In those cases, in which output of material to recycling were presented, material transportation to recycling plant was included. This principle was applied to plastic, board and metal recycled by a third party.

For generic data Mexicaniuh and Ecoinvent 3.3 (Allocation - Recycled Content version) databases were used.

5.7. Time representativeness

Direct data obtained from AHMSA is representative for 2016.

5.8. Data quality assessment

Data quality assessment per module is provided in Tables 7, 8 and 9.

Table 7. Raw materials supply module data quality assessment					
Data	**Time related coverage**	**Geogrphic coverage**	**Technological coverage**	**Data source**	**Measured or estimated**
Raw materials consumption	2016	Mexico	Modern	AHMSA	M
Raw materials production of primary processes	2016	Mexico	Modern	AHMSA	M
Raw materials production of pig iron & steel and hot rolling	1990-2016	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E
Fuels consumption and emissions related to electricity generation and distribution in Mexico	2016	Mexico	Mexican energy mix	Mexicaniuh	M&E
Fuels consumption and emissions related to AHMSA's electricity generation and distribution	2016	Mexico	Modern	Mexicaniuh & AHMSA	M&E
Energy consumption and generation of emissions related to natural gas production in Mexico	2016	Mexico	Mexican context	Mexicaniuh	M&E

M&E: Measured and Estimated, M: Measured, E: Estimated

Table 8. Transportation module data quality assessment					
Data	**Time related coverage**	**Geogrphic coverage**	**Technological coverage**	**Data source**	**Measured or estimated**
Transport distance of raw materials, auxiliary supplies, fuels & packaging materials	2016	Mexico	N/A	AHMSA	M
Transportation of raw materials, auxiliary supplies, fuels & packaging materials	1992-2014	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E
Consumption of materials and energy and emissions related to the transport requirements of raw materials and auxiliary inputs	1992-2014	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E
Consumption of materials and energy and emissions related to internal transport requirements	2016	Mexico	N/A	AHMSA	M&E

M&E: Measured and Estimated, M: Measured, E: Estimated

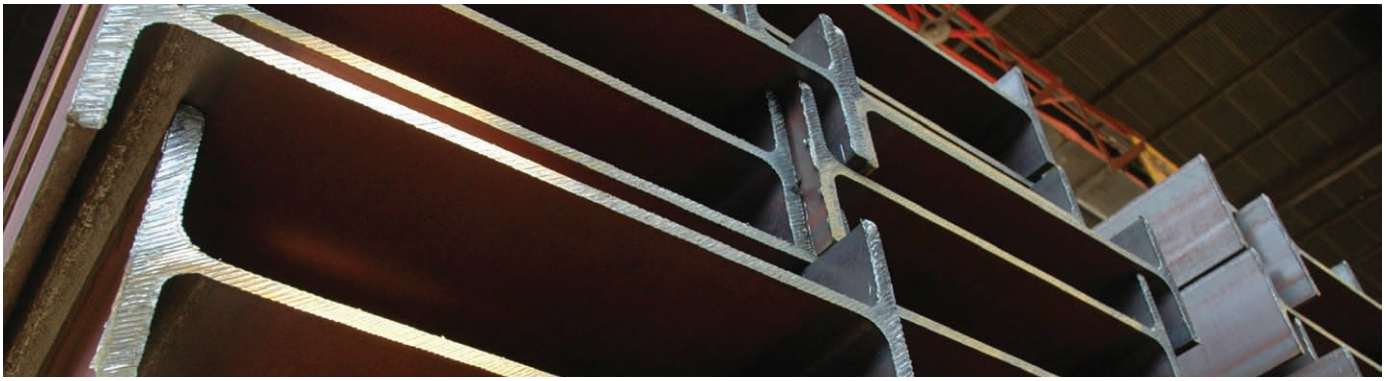

Table 9. Manufacture module data quality assessment					
Data	**Time related coverage**	**Geogrphic coverage**	**Technological coverage**	**Data source**	**Measured or estimated**
Water consumption	2016	Mexico	Modern	AHMSA	M
Consumption of auxiliary supplies during manufacturing	2016	Mexico	Modern	AHMSA	M
Consumption of energy and materials for the manufacture of auxiliary materials	1990 - 2016	Worldwide average based on Europe	Worldwide average based on Europe	Ecoinvent 3.3	M&E
Packaging materials production for raw materials & auxiliary supplies	1990-2016	World average based on Europe	World average based on Europe	Ecoinvent 3.3	M&E
Waste generation	2016	Mexico	Modern	AHMSA	M
Processes of waste treatment, consumptions of materials and related energy	1990 - 2017	Worldwide average based on Europe	Worldwide average based on Europe	Ecoinvent 3.3	M&E
Air emissions and wastewater generation	2016	Mexico	Modern	AHMSA	M
Waste transportation to the treatment & final disposal site	2016	Mexico	Modern	AHMSA	M
Consumption of materials and energy and emissions related to waste transport requirements	1992-2014	Worldwide average based on Europe	Worldwide average based on Europe	Ecoinvent 3.3	M&E

M&E: Measured and Estimated, M: Measured, E: Estimated

6. Environmental performance

SimaPro 8.4 was used for Life Cycle Impact Assessment

6.1. Use of resources

Parameters describing resource use were evaluated with the Cumulated Energy Demand method version 1.09 (Frischknecht et al. 2007) except for the indicator of use of net fresh water that was evaluated with Recipe 2016 Midpoint (H) version 1.00 (Huijbregts et al. 2017). The detailed description of the use of resources per declared unit is provided in Table 10.

Table 10. Resource Indicators per metric ton of hot rolled structural shapes						
Parameter	**Unit**	**A1) Raw materials supply**	**A2) Transportation**	**A3) Manufacturing**	**Total A1 - A3**	**A4 - A5, B1-B7, C1-C4, D**
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	289	16	569	874	
Use of renewable primary energy as raw materials	MJ	0	0	0	0	
Total use of renewable primary energy resources	MJ	289	16	569	874	
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	17 003	639	3 371	21 013	
Use of non-renewable primary energy used as raw materials	MJ	0	0	0	0	Modules not declared
Total use of non-renewable primary energy resources	MJ	17 003	639	3 371	21 013	
Use of secondary material	kg	0	0	0	0	
Use of renewable secondary fuels	MJ	0	0	0	0	
Use of non-renewable secondary fuels	MJ	0	0	0	0	
Use of net fresh water	m^3	3 883	0	8	3 891	

6.2. Potential environmental impact

Parameters describing environmental potential impacts were calculated using CML-IA method version 3.04 (Guinee et al. 2001; Huijbregts et al. 2003; Wegener et al. 2008) as implemented in SimaPro 8.4. Water scarcity potential was calculated using AWARE method (Boulay et al. 2018). Table 11 shows the LCA results per declared unit and Figure 2 depicts the impact contribution per module.

Table 11. Potential environmental impact indicators per metric ton of hot rolled structural shapes						
Impact Category	**Unit**	**A1) Raw materials supply**	**A2) Transportation**	**A3) Manufacturing**	**Total A1 - A3**	**A4 - A5, B1-B7, C1-C4, D**
Abiotic depletion	kg Sb equiv %	4.37E-03 91.4	6.83E-05 1.4	3.45E-04 7.2	4.78E-03 100	
Abiotic depletion (fossil fuels)	MJ %	16 868 82	620 3	3 054 15	20 543 100	
Global warming (GWP100a)	kg CO_2 equiv %	500 61	43 5	277 34	820 100	
Ozone layer depletion (ODP)	kg CFC-11 equiv %	5.42E-05 71.9	7.84E-06 10.4	1.33E-05 17.7	7.54E-05 100	Modules not declared
Photochemical oxidation	kg C_2H_4 eq %	0.28 63	0.01 3	0.15 34	0.44 100	
Acidification	kg SO_2 equiv %	4.21 63	0.35 5	2.10 32	6.66 100	
Eutrophication	kg PO_4--- eq %	1.63 67.6	0.07 2.8	0.72 29.6	2.42 100	
Water scarcity potential	m^3eq %	138 116 99	12 0	805 1	138 933 100	

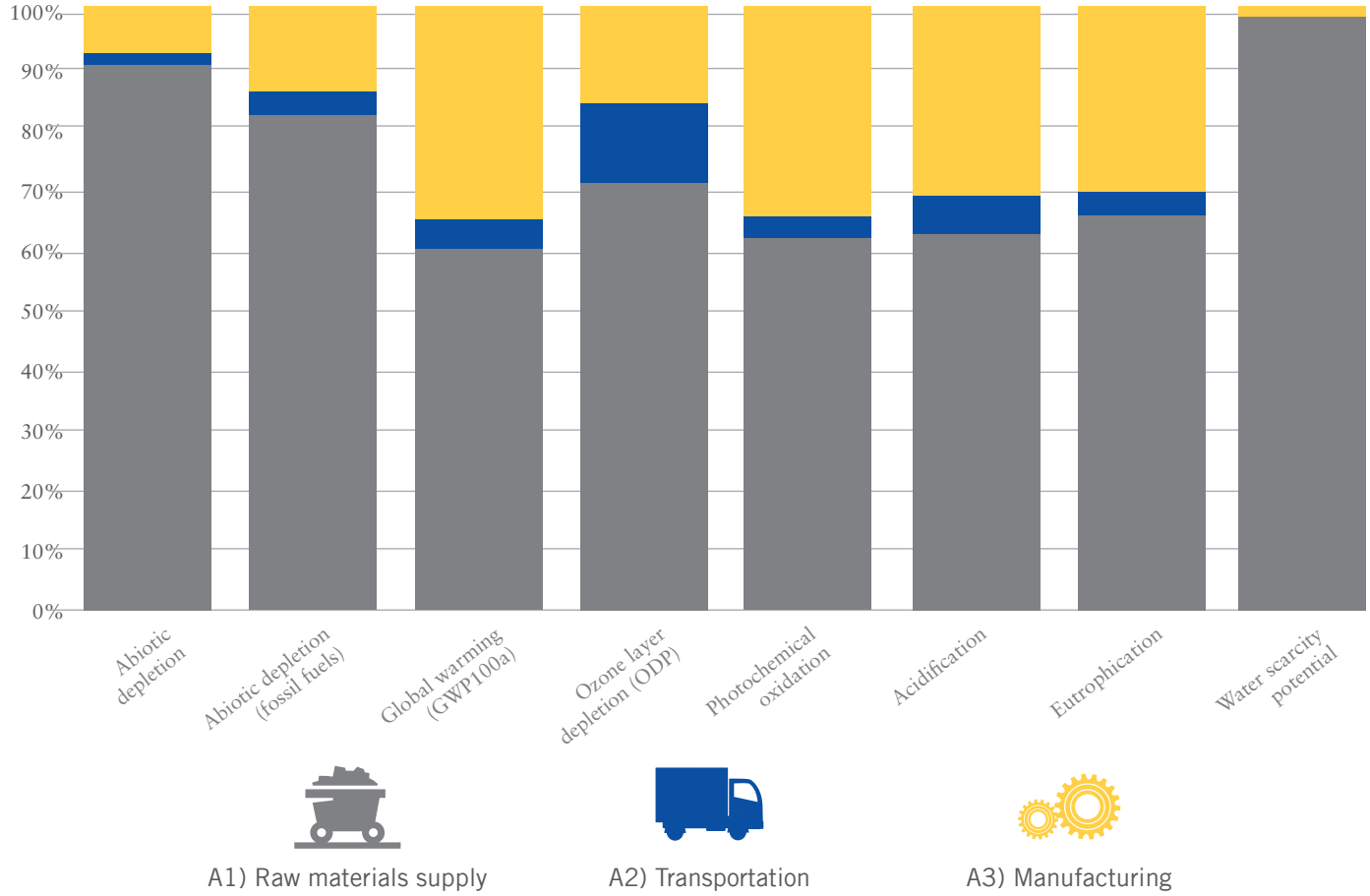

Figure. 2 Potential environmental impact contribution per metric ton of hot rolled structural shapes

6.3. Waste production

Environmental indicators describing waste generation were obtained from LCI except for background information which has been calculated using EDIP 2003 method (Hauschild and Potting, 2005). Table 12 shows waste and other outputs generated during each information module.

Table 12. Waste and other outputs per metric ton of hot rolled structural shapes

Output parameter	Unit	A1) Raw materials supply	A2) Transportation	A3) Manufacturing	Total A1 - A3	A4 - A5, B1-B7, C1-C4, D
Hazardous waste	kg	3.82E-02	4.83E-04	375	375	Modules not declared
Non hazardous waste	kg	26.6	16.9	15.9	59.4	
Radioactive waste*	kg	9.61E-03	3.76E-03	7.63E-03	2.10E-02	
Components for reuse	kg	0	0	0	0	
Materials for recycling	kg	0	0	0	0	
Materials for energy recovery	kg	0	0	0	0	
Exported electricity	MJ	0	0	0	0	
Exported heat	MJ	0	0	0	0	

*No radioactive waste is produced during AHMSA operation.

7. Additional information

AHMSA has the following certifications:

• The first steel company certified in ISO 14001 in Latin America, since 1996.
• ISO 9001:2008 to hot rolling manufacturing process of steel plate & stripe.
• ISO/TS 16949:2009 Quality management systems — Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations.
• Clean Industry under Federal Attorney's Office for Environmental Protection (PROFEPA).

AHMSA has the following awards:

• Millenium Bussiness Award for Environmental Achievement given by UN Environment and the International Chamber of Commerce in 2000.
• 1st place for reducing CO_2 emissions in the Environmental Leadership for Competitiveness Program by Federal Attorney's Office for Environmental Protection (PROFEPA) in 2012.
• 2nd place for saving water in the Environmental Leadership for Competitiveness Program given by Federal Attorney's Office for Environmental Protection (PROFEPA) in 2012.
• Leading company in the Environmental Leadership for Competitiveness Program given by Federal Attorney's Office for Environmental Protection (PROFEPA) in 2016.

Biodiversity

AHMSA and subsidiaries create and manage five environmental units for wildlife protection, with more than 100 thousand hectares. Different species of animals are preserved, like white-tail deer, moose, bighorn sheep, black bear, among others.
AHMSA and subsidiaries supply goats and cattle to people of regions: coal, central and northern of the State. AHMSA also support to genetic refinement program for cattle, orchards of pomegranates, nogalera, oats, melon, cucumber, chard, corn, among others.
AHMSA manages and operates the municipal zoo with species such as: African lion, tiger, puma, lynx, black bear, American wolf, diverse species in birds, among others.

Afforestation activities

AHMSA and subsidiaries built and operate three nurseries where trees from the region are grew. These nurseries have a production capacity of 370 thousand plants per year. AHMSA donates trees to schools as well as municipal and state institutions.

8. Verification and registration

Programme:	International EPD® System www.environdec.com EPD registered through the fully aligned regional programme/hub: EPD Latin America www.epd-americalatina.com
Programme operator:	EPD International AB / Box 210 60 / SE-100 31 Stockholm, Sweden EPD Latin America / Chile: Alonso de Ercilla 2996, Ñuñoa, Santiago Chile. Mexico: Av. Convento de Actopan 24 Int. 7A, Colonia Jardines de Santa Mónica, Tlalnepantla de Baz, Estado de México, México, C.P. 54050
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PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact via info@environdec.com
Independent verification of the declaration data, according to ISO 14025:2006.	EPD process certification (Internal) ☐ EPD verification (External) ☑
External third-party verifier and critical reviewer of the LCA:	Claudia A. Peña ADDERE Research & Technology Approved EPD verifier cpena@addere.cl, claudia@epd-americalatina.com
Accredited or approved by:	The International EPD® System

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