# Steel rebar manufactured from steel scrap

Environmental Product Declaration
In accordance with ISO 14025:2006 and EN 14804:2012

| | |
|---|---|
| Programme: | The International EPD® System<br>EPD registered through the fully aligned regional programme/hub:<br>EPD Latin America |
| Programme operator: | EPD International AB<br>Regional Hub: EPD Latin America |
| EPD registration number: | S-P-01235 |
| Issue date: | 2018-11-08 |
| Validity date: | 2023-11-06<br>An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com |
| Revision date: | 2018-11-07 |
| Geographical scope: | Mexico |

# Content

# 1. DEACERO

DEACERO is a world-class company that produces a wide range of steel products. Through productivity, excellence in quality and innovation in its products, as well as the focus on customer service, DEACERO has managed to meet the needs of local and international markets, positioning itself as a leader in the field.

DEACERO is a 100% Mexican company that has managed to transform and grow firmly to efficiently respond to the demands of an international market of high level of competition in more than 20 countries in America and Europe.

The quality of DEACERO is a tradition in the market, therefore, it has invested in more training, better products and in integrated production processes that allow serving the agricultural, industrial, construction and domestic sectors.

DEACERO conceives sustainability in its three dimensions: social, economic and environmental, in relation to the latter, it is a company that takes care of the environment of the communities through advanced water, air and soil protection systems. DEACERO conceives progress as productivity that develops with an ecological sense.

DEACERO is strongly committed to a sustainable strategy of growth that benefits the company, the environment, their employees and the communities in which operates. DEACERO is a fully integrated company with an infrastructure for recycling, processing waste, steel mills, finished product plants and distribution centers.

As an organization DEACERO strives for physical health and implementation of values, smart use of natural resources, and stable growth together with their customers and suppliers. The company owns developments in advanced technology for steel recycling facilities and its transformation to finish products.

This Environmental Product Declaration (EPD) is in accordance with ISO 14025 and EN 15804, for steel rebar manufactured from steel scrap.

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: | Steel rebar manufactured from steel scrap |
|---|---|
| Declaration owner: | DEACERO S.A.P.I de C.V.<br>Avenida Lázaro Cárdenas, Zona Loma Larga Oriente,<br>San Pedro Garza García, Nuevo León, México<br>C.P. 66266<br>Contact person: Daniel Armando Guajardo Hernández<br>dguajardo@deacero.com |
| Description of the construction product: | Steel rebar used to reinforce concrete in the construction industry. The surface of the rebar is corrugated to limit the relative longitudinal movement between the steel and the surrounding concrete. |
| Declared Unit: | 1 metric ton of steel rebar manufactured from steel scrap. |
| Construction product identification: | Central Product Classification: CPC 4124<br>Bars and rods, hot rolled, of iron or steel |
| Description of the main product components and or materials: | 100% Steel manufactured using scrap steel as source of iron,<br>Grade 42 and Grade 52 |
| 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 Module A1, A2 and A3:<br>• Product definition and physical data.<br>• Information about raw materials and origin.<br>• Specifications on manufacturing the product.<br>• Notes on product processing.<br>• LCA based on a declared unit, cradle-to-gate.<br>• LCA results.<br>• Evidence and verifications. |
| For more information consult: | www.deacero.com |
| Site for which this EPD is representative: | **Manufacturing Plant**<br>CELAYA: Carretera #45 Panamericana tramo Celaya - Salamanca km 64.8<br>Poblado de Chinaco, Villagrán Guanajuato C.P. 38080, México |
| Public intended: | B2B (Business to Business) |

# 3. Product Description

The rod is a bar of corrugated steel adaptable to different structures of reinforcement of concrete available in different diameters according to specifications of work. DEACERO produces the corrugated rod with electric arc furnace technology in Celaya, Guanajuato, following the manufacturing standard NMX-C-407-ONNCCE-2001.

The rebar is commonly used for fences, beams, columns, solid and lightweight slabs. It is made of low carbon steel in straight or bent presentation. The rebar has corrugated "V" for greater adherence to concrete, is malleable and adaptable, in addition to having uniform steel properties.

**Uses**

- Concrete reinforcement structures
- Concrete slabs and columns

**Features**

- Low carbon steel
- Straight or bend bundle presentations
- Meets ASTM and other quality control standards

**Advantages**

- W corrugated for better adherence to concrete surfaces
- Adaptable and easy to bend
- Consistent mechanical properties

### 3.1 Technical specifications

*Table 1. Technical specification (Grade 42 and 52)*

| DIAMETER / (plg) | PRESENTATION | LENGTH (m) | PRESENTATION | | BARS PER PACK |
|---|---|---|---|---|---|
| | | | BARS PER BUNDLE (m) | BUNDLES PER PACK | |
| 3/8 | straight | 9.15 | - | - | - |
| 3/8 | straight | 12 | 25 | 10 | 250 |
| 3/8 | bent | 12 | 25 | 10 | 250 |
| ½ | straight | 9.15 | - | - | - |
| ½ | straight | 12 | 15 | 10 | 150 |
| ½ | bent | 12 | 15 | 10 | 150 |
| 5/8 | straight | 12 | 10 | 10 | 100 |
| ¾ | straight | 12 | 7 | 10 | 70 |
| 1 | straight | 12 | 4 | 10 | 40 |
| 1 ¼ | straight | 12 | - | - | 24 |
| 1 ¼ | straight | 12 | - | - | 16 |
| 1 3/8 | straight | 12 | - | - | 24 |
| 1 ½ | straight | 12 | - | - | 16 |

### 3.2 Mechanical properties

*Table 2. Mechanical properties*

| Grade | **42** | **52** |
|---|---|---|
| Resistance to stress (kg/mm$^2$) | 63 | 72 |
| Minimum yield stress Ultimate tensile strength (kg/mm$^2$) | 42 | 52 |

## 4. Content declaration

The steel rebar manufactured from steel scrap by DEACERO is made of 100% low alloyed steel manufactured in electric arc furnace with 94% of recycled material. The typical composition of the low alloyed is presented Table 3.

*Table 3. Typical content of low-alloyed steel rebar scrap manufactured by DEACERO*

| Element | Typical content |
|---|---|
| Iron | 94.6 % |
| Carbon | 3.4 % |
| Manganese | 1.4 % |
| Silicon | 0.2 % |
| Phosphorus | 0.1 % |
| Sulfur | < 0.1 % |
| Copper | 0.3 % |

# 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 steel rebar manufactured from steel scrap.**

## 5.2 System boundary

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). The declared EPD is a "Cradle-to gate EPD" in line 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. The following figure describes the scope of the inventory performed in the LCA.

Description of the system boundary is in Table 4.

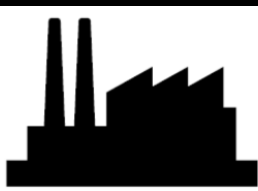
*Table 4. Steel rebar scrap manufactured by DEACERO product system*

| Life cycle environmental information of steel rebar manufactured from steel scrap | | | | | | | Other environmental information |
|---|---|---|---|---|---|---|---|
| A1 - A3 | | | A4 - A5 | | B1 - B7 | C1 - C4 | D |
| Product stage | | | Construction process stage | | Use stage | End of life stage | Reuse recovery stage |
| A1 | A2 | A3 | A4 | A5 | B1 - B7 | C1 - C4 | |
| Steel scrap pre-processing, production of ferroalloys, lime, carbon, graphite electrodes, calcium carbide and packaging of raw materials. Electricity generation and natural gas production used during manufacturing. | Transportation of scrap steel to production plant. Transportation of other raw materials. Transport of auxiliary supplies from the production site to the DEACERO plant and internal transports. | Production and consumption of auxiliary materials: argon, nitrogen, chemical reagents, lubricating oil, oxygen, solvents, refrigerants and tow. Waste transport and waste treatment. Emissions to air from the operations of DEACERO. | Product distribution | Construction and installation | Use, maintenance, repair, replacement, refurbishment, operational energy use, operational water use | De-construction, demolition, transport, waste processing, disposal | Re-use-Recovery-Recycling-potential |
| **X** | **X** | **X** | MND | MND | MND | MDN | MND |
| Cradle-to-gate<br>Declared unit | | | These stages are not considered in the present study that allows the scope to be from cradle to grave | | | | |

*Included = x   *MND = Module Not Declared

In the table 5 is description of information modules included

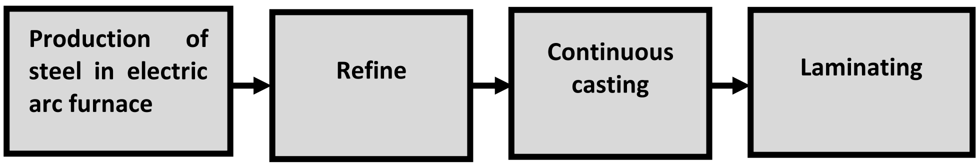
*Table 5. Description of information modules included in this EPD.*

| **A1) Raw materials supply** | **A2) Transportation** | **A3) Manufacturing** |
|---|---|---|
| <br>• Pre-processing of steel scrap.<br>• Production of raw materials: ferroalloys, lime, carbon, graphite electrodes, calcium carbide.<br>• Production of packaging materials for raw materials.<br>• Generation and distribution of the electricity consumed in manufacturing.<br>• Generation and distribution of the natural gas consumed in manufacturing. | <br>• Transportation of scrap steel.<br>• Transportation of other raw materials.<br>• Transportation of auxiliary materials.<br>• Internal transportation requirements. | <br>• Consumption of fresh water.<br>• Production and consumption of auxiliary materials: oxygen, nitrogen, chemicals for water treatment, textiles for cleaning and maintenance, lubricating oils and grease.<br>• Waste generation and waste management processes.<br>• Emissions to air.<br>• Transport of waste to the treatment and final disposal site. |

## 5.3 Description of the manufacturing process

The manufacturing process is described in Figure 1:

*Figure. 1. Flow diagram of steel rebar scrap manufactured process*




## 5.4 Assumptions

Celaya steelworks:

• ferroalloys are obtained in polypropylene bags.

• plastic waste is recycled in the same municipality where it was generated.

• Hazardous waste is solids impregnated with grease and oils.

## 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 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 steel rebar scrap manufacturing.

*Table 6. Coproduct generated in steel rebar manufacturing*

| Unit process | Coproduct |
|---|---|
| EAF | Slag |
| Laminating | Steel scale |

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 steel rebar 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 and metal containers 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 DEACERO is representative for 2017.

## 5.8 Data quality assessment

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

*Table 7.Raw material supply module data quality assessment*

| Data | Time related coverage | Geographic coverage | Technological coverage | Data source | Measured or estimated |
|---|---|---|---|---|---|
| Consumption of raw materials for the manufacture of rebar from scrap | 2017 | Mexico | Modern | DEACERO | M |
| Transport distance of Steel scrap to pre-processing plants | 2017 | Mexico | Modern | DEACERO | M |
| Energy and materials consumption, waste and emissions generation from pre-processing steel scrap | 2017 | Mexico | Modern | DEACERO | M |
| Energy consumption per type for manufacturing rod from scrap | 2017 | Mexico | Modern | DEACERO | M |
| Consumption of fuels and emissions related to electricity production in Mexico at country level | 2017 | Mexico | Mix tecnológico Mexico | Mexicaniuh | M&E |
| Energy and materials consumption and emissions related to natural gas production in Mexico | 2017 | Mexico | Mix para Mexico | Mexicaniuh | M&E |
| Consumption of energy and materials for the manufacture of steelmaking raw materials | 1990-2017 | Mix european | Modern | Ecoinvent 3.3 | M&E |

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

*Table 8. Transportation module data quality assessment*

| Data | *Time related coverage* | *Geographic coverage* | *Technological coverage* | *Data source* | *Measured or estimated* |
|---|---|---|---|---|---|
| Transport distance of scrap and other raw materials | 2017 | Mexico | N/A | DEACERO | M |
| Transport distance of auxiliary supplies | 2017 | Mexico | N/A | DEACERO | M |
| Consumption of materials and energy and emissions related to the transport requirements of raw materials and auxiliary inputs. | 1992-2014 | Mix european | Mix european | Ecoinvent 3.3 | M&E |

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

*Table 9. Manufacture module data quality assessment*

| Data | *Time related coverage* | *Geographic coverage* | *Technological coverage* | *Data source* | *Measured or estimated* |
|---|---|---|---|---|---|
| Production yield and generation of by-products. | 2017 | Mexico | Modern | DEACERO | M |
| Consumption of auxiliary materials during manufacturing. | 2017 | Mexico | Modern | DEACERO | M |
| Consumption of energy and materials for the manufacture of auxiliary materials. | 1990 - 2017 | Worldwide average based on Europe | Worldwide average based on Europe | Ecoinvent 3.3 | M&E |
| Waste generation during manufacture | 2017 | Mexico | Modern | DEACERO | 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 |
| Emissions to air and water during the manufacturing process | 2017 | Mexico | Modern | DEACERO EPA AP42 | M |
| Waste transport distance | 2017 | Mexico | Modern | DEACEROy Google Maps | 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 is provided in Table 10.

*Table 10. Resource Indicators per metric ton of steel rebar manufactured from steel scrap*

| ***Parameter*** | ***Unit*** | ***Total*** | ***A1) Raw materials supply*** | ***A2) Transportation*** | ***A3) Manufacturing*** |
|---|---|---|---|---|---|
| Use of renewable primary energy excluding renewable primary energy resources used as raw materials | MJ | 395 | 338 | 5.9 | 50 |
| Use of renewable primary energy as raw materials | MJ | 0 | 0 | 0 | 0 |
| Total use of renewable primary energy resources | MJ | 395 | 338 | 5.9 | 50 |
| Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials | MJ | 9 479 | 8185 | 417 | 876 |
| Use of non-renewable primary energy used as raw materials | MJ | 0 | 0 | 0 | 0 |
| Total use of non-renewable primary energy resources | MJ | 9 479 | 8185 | 417 | 876 |
| Use of secondary material | kg | 1 088 | 0 | 0 | 1088 |
| 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 | m3 | 2.79 | 0.67 | 0.08 | 2.04 |

## 6.2 Potential environmental impact

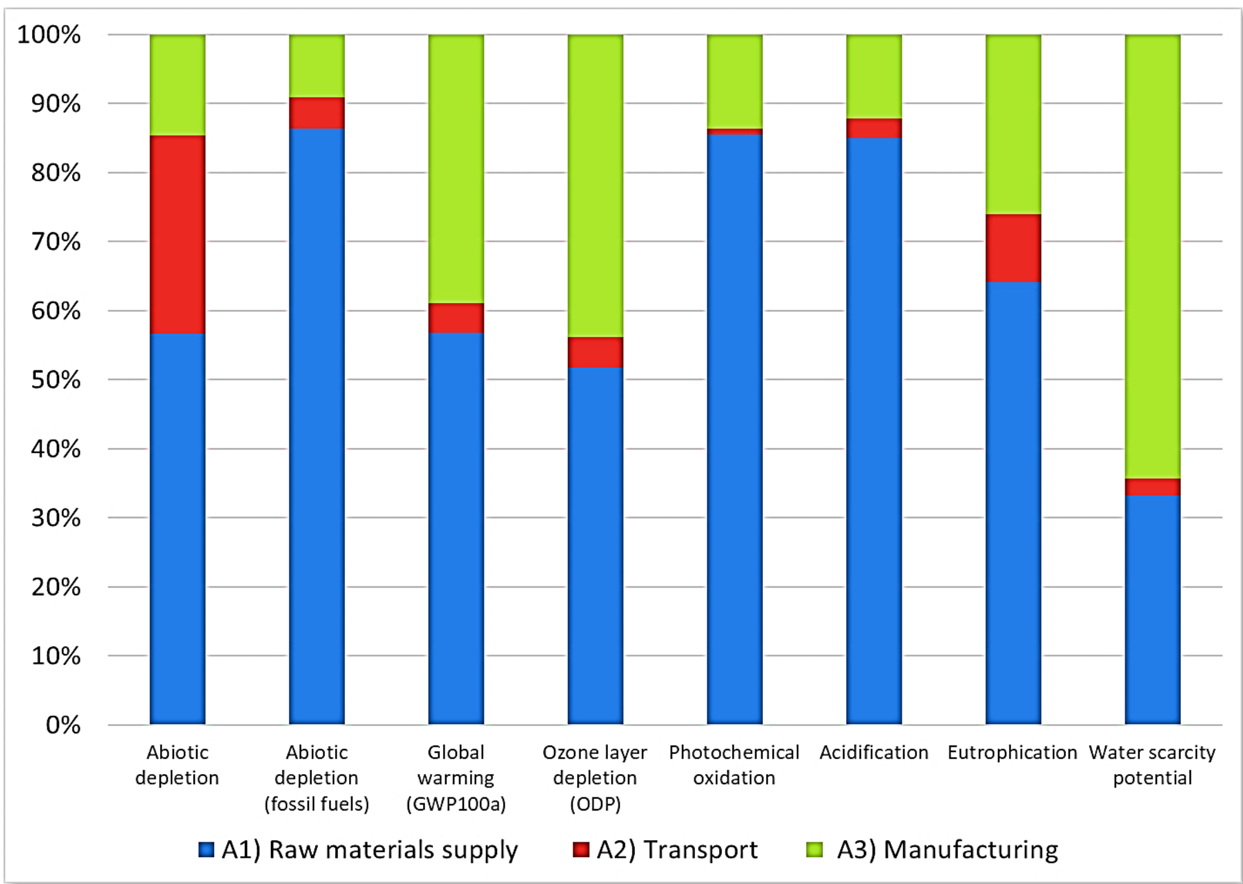
All information modules are reported and value separately. However, in the present EPD presents itself the total impact across all stage.

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. Potential environmental impact indicators per metric ton of steel rebar manufactured from steel scrap*

| Impact category | Unit | A1) Raw materials | A2) Transportation | A3) Manufacture | Total A1 - A3 | A4-A5, B1-B2, CI-C4, D |
|---|---|---|---|---|---|---|
| Abiotic depletion | kg Sb eq | 1.36E-04 | 6.89E-05 | 3.53E-05 | 2.41E-04 | Modules not declared |
| | % | 57% | 29% | 15% | 100% | |
| Abiotic depletion (fossil fuels) | MJ | 7.78E+03 | 4.11E+02 | 8.21E+02 | 9.01E+03 | |
| | % | 86% | 5% | 9% | 100% | |
| Global warming (GWP100a) | kg CO2 eq | 3.56E+02 | 2.65E+01 | 2.44E+02 | 6.27E+02 | |
| | % | 57% | 4% | 39% | 100% | |
| Ozone layer depletion (ODP) | kg CFC-11 eq | 5.40E-05 | 4.65E-06 | 4.58E-05 | 1.04E-04 | |
| | % | 52% | 4% | 44% | 100% | |
| Photochemical oxidation | kg C2H4 eq | 5.40E-01 | 5.06E-03 | 8.62E-02 | 6.31E-01 | |
| | % | 86% | 1% | 14% | 100% | |
| Acidification | kg SO2 eq | 3.88E+00 | 1.29E-01 | 5.58E-01 | 4.57E+00 | |
| | % | 85% | 3% | 12% | 100% | |
| Eutrophication | kg PO4--- eq | 1.99E-01 | 3.05E-02 | 8.07E-02 | 3.10E-01 | |
| | % | 64% | 10% | 26% | 100% | |
| Water scarcity potential | $m^3$eq | 11.6 | 0.8 | 22.5 | 35.0 | |
| | % | 33% | 2% | 64% | 100% | |

*Figure. 2 Potential environmental impact contribution per metric ton steel rebar manufactured from steel scrap*



## 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 steel rebar manufactured from steel scrap*

| Output parameter | Unit | Total | 1) Raw materials supply | A2) Transportation | A3) Manufacturing |
|---|---|---|---|---|---|
| Hazardous waste | kg | 0.02 | 0.01 | 2.61E-04 | 8.80E-04 |
| Non hazardous waste | kg | 56.5 | 32 | 15.4 | 8.6 |
| Radioactive waste* | kg | 0.01 | 0.01 | 2.62E-03 | 1.49E-03 |
| Components for reuse | kg | 0 | 0 | 0 | 0 |
| Materials for recycling | kg | 29.4 | 0 | 0 | 29.4 |
| 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 DEACERO operation.

# 7. Verification and registration

| CEN standard EN 15804 served as the core PCR | |
|---|---|
| Programme | International EPD® System<br>www.environdec.com<br><br>EPD registered through the fully aligned regional programme/hub:<br>EPD Latin America<br>www.epdlatinamerica.com |
| Programme operator | EPD International AB<br>Box 210 60<br>SE-100 31 Stockholm, Sweden<br><br>EPD Latin America<br>Chile: Alonso de Ercilla 2996, Ñuñoa, Santiago Chile.<br>Mexico: Av. Convento de Actopan 24 Int. 7A, Colonia Jardines de Santa Mónica, Tlalnepantla de Baz, Estado de México, México, C.P. 54050 |
| EPD registration number: | S-P-01235 |
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| Date of validity: | 2023-11-06 |
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| Reference year of data: | 2017 |
| Geographical scope: | Mexico |
| Product group classification: | CPC 4124<br>Bars and rods, hot rolled, of iron or steel |

| | |
|---|---|
| PCR: | PCR 2012:01 construction products and construction services, Version 2.2 (2017-05-03) |
| 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)<br>☒ EPD verification (External) |
| External third-party verifier and critical reviewer of the LCA: | Claudia A. Peña<br>ADDERE Research & Technology<br>Approved EPD verifier<br>cpena@addere.cl, claudia@epd-americalatina.com |
| Accredited or approved by: | The International EPD® System |

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Wegener AS, van Oers L, Guinée JB, Struijs J, Huijbregts MAJ (2008) Normalisation in product life cycle assessment: An LCA of the global and European economic systems in the year 2000. Science of The Total Environment. Volume 390, Issue 1. Pages 227-240. ISSN 0048-9697. https://doi.org/10.1016/j.scitotenv.2007.09.040.