

ENVIRONMENTAL
PRODUCT
DECLARATION

HOT ROLLED STRUCTURAL AND RAIL



Produced under the Australasian EPD Programme in accordance with ISO 14025 and EN 15804

EPD registration number | S-P-00854 Version 1
Approval date | 2016-11-08
Valid until | 2021-11-08
Geographical scope | Australia

GENERAL INFORMATION

An Environmental Product Declaration, or EPD, is a standardised and verified way of quantifying the environmental impacts of a product based on a consistent set of rules known as a PCR (Product Category Rules).

Declaration owner: **OneSteel NSW Pty Ltd (Subject to a Deed of Company Arrangement)**
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CEN standard EN 15804 served as the core PCR:

PCR: PCR 2012:01 Construction products and Construction services, Version 2.0, 2015-03-03

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 and data, according to ISO 14025:

- EPD process certification (Internal)
- EPD verification (External)

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Accredited or approved by: The Australasian EPD® Programme

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onesteel

WELCOME

OneSteel's flexible, local integrated supply chain, superior product quality and technical expertise positions us as a partner to Australia's construction industry.

Our core competencies in metallurgy, steel manufacture, supply chain, logistics, expert consultation and information management, support you in building Australia's future.

OneSteel is dedicated to conducting our business to global environmental, social and commercial standards. Our commitment to the environment includes optimising the eco-efficiency of our products through the product life cycle. This means increasing resource and energy efficiencies in the production and distribution of our products, and during the use of steel products. We are committed to the promotion of the recovery, reuse and recycling of steel and other products.

OneSteel's Environmental Product Declarations (EPDs) are independently verified and are premier contributors to our holistic commitment to the environmentally sustainable manufacture and application of our products. Alongside our sustainable manufacturing practices, including the internationally adopted Polymer Injection Technology, and our technical product and application expertise and customisation, EPDs are another way we are here to help add value back to our customers and the wider industry.

Recognising our customers' need and the increasing demand for standardisation and greater transparency around environmental performance, OneSteel is proud to publish the sustainability credentials of our supply chain and products.

www.onesteel.com

HOW TO USE THIS EPD

OneSteel recognises the importance of transparency and the independent verification of our products' credentials. This Environmental Product Declaration (EPD) covers the environmental impacts of structural, merchant bar and rail products manufactured to the following Australian Standards and typically used in the construction, manufacturing and rail industries;

- 1) AS/NZS 3679.1 Structural Steel Part 1: Hot rolled bars and sections
- 2) AS 1085.1 Railway track material. Part 1: Steel rails
- 3) AS 1085.17 Railway track material. Part 17: Steel sleepers

Our products manufactured to AS/NZS 3679.1 are third-party certified by the Australasian Certification Authority for Reinforcing and Structural Steels (ACRS) to independently confirm they consistently meet the requirements of the Standard.

GENERAL GUIDANCE

EPDs are independently verified documents that include information about the environmental impact of products throughout their life cycle.

EPDs require the completion of Life Cycle Inventory (LCI), a Life Cycle Assessment (LCA) and verification to best practice international and Australian standards.

- Life Cycle Inventory (LCI) is the collection of data on the inputs, processes and outputs within a defined system boundary.
- Life Cycle Assessment (LCA) is the modelling of LCI in accordance with ISO 14040 and ISO 14044 standards.
- Third party verification of the output of the LCA in the format of an EPD.

EPDS ARE NOT ALWAYS COMPARABLE

When comparing EPDs it is important to recognise:

- EPDs within the same product category from different programmes may not be comparable
- 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
- EPDs of construction products from a group of manufacturers may not be comparable to an EPD of a similar construction product that has been generated by a single manufacturer.

Understanding the detail is important in comparisons. Expert analysis is required to ensure data is truly comparable, to avoid unintended distortions.





BENEFITS OF USING THIS EPD

- Provides an independently verified representation of the environmental impact of the OneSteel product going into your project.
- Complies with the requirements of a valid EPD that is recognised in the Green Star Design & As Built v1.1 and Innovation Challenge of Green Star legacy tools by the Green Building Council of Australia (GBCA).
- Complies with the requirements of IS[®] rating tool by the Infrastructure Sustainability Council of Australia (ISCA).

GREEN STAR[®] POINTS

This EPD complies with requirements under the Green Building Council of Australia's rating tool, Green Star – Design & As Built v1.1.

Green Star points for EPDs can be claimed under the Sustainable Products credit when the following criteria are met:

- ✓ EN 15804 and ISO 14025 compliant
- ✓ Verified by an independent third party
- ✓ Cradle-to-gate scope.

This EPD meets these requirements.



"Environmental Product Declarations are important as we strive to create sustainable places for people. By providing the market with EPDs, OneSteel is leading the way in the building materials sector and providing great value to sustainability professionals through accurate and reliable data."

Romilly Madew,
Chief Executive Officer, Green Building Council of Australia.



IS TOOL[®]

This EPD complies with requirements under the Infrastructure Sustainability Council of Australia's IS[®] rating scheme.

Points can be claimed under the IS[®] rating scheme v1.2 *Environmentally labelled products and supply chains* credit (Mat-2) when the following criteria are met.

- ✓ Compliant with ISO 14025
- ✓ Compliant with EN15804
- ✓ Verified by a third party.

This EPD meets these requirements.



"OneSteel has demonstrated their commitment to a sustainable built environment with the development of EPDs for their construction products. EPD's are recognised and rewarded in the IS[®] rating scheme as a means of transparently reporting the environmental impacts of construction materials. ISCA is committed to working with all parts of the supply chain to improve the sustainability outcomes of infrastructure in Australasia. We continue to drive the adoption of integrated outcomes based on social, economic and environmental practices – it's about more than just carbon emissions."

Antony Sprigg,
CEO Infrastructure Sustainability Council of Australia



BENEFITS OF USING ONESTEEL PRODUCTS

WHY STEEL?

Steel is fundamental to the way we live, work and play.

As one of the most utilised materials in the world, steel supports the buildings we use, strengthens the roads and bridges that connect us and contributes to a more sustainable built environment.

From design and construction, through to use and then at end-of-life of buildings or infrastructure, steel offers construction proponents unique sustainability benefits.

Steel can be readily adapted and reused. It allows asset owners to modify existing structures to cater for future uses and tenants, as well as extending the structure's lifespan beyond its initial intent.

Steel is a 100% recyclable material, with no loss in material strength or quality.

Modern design techniques and the use of higher strength grades can also reduce the mass of steel used in structures.

To understand the environmental performance of steel, the full life cycle of steel must be taken into consideration. The key steps in the life cycle of steel are shown in Figure 1.

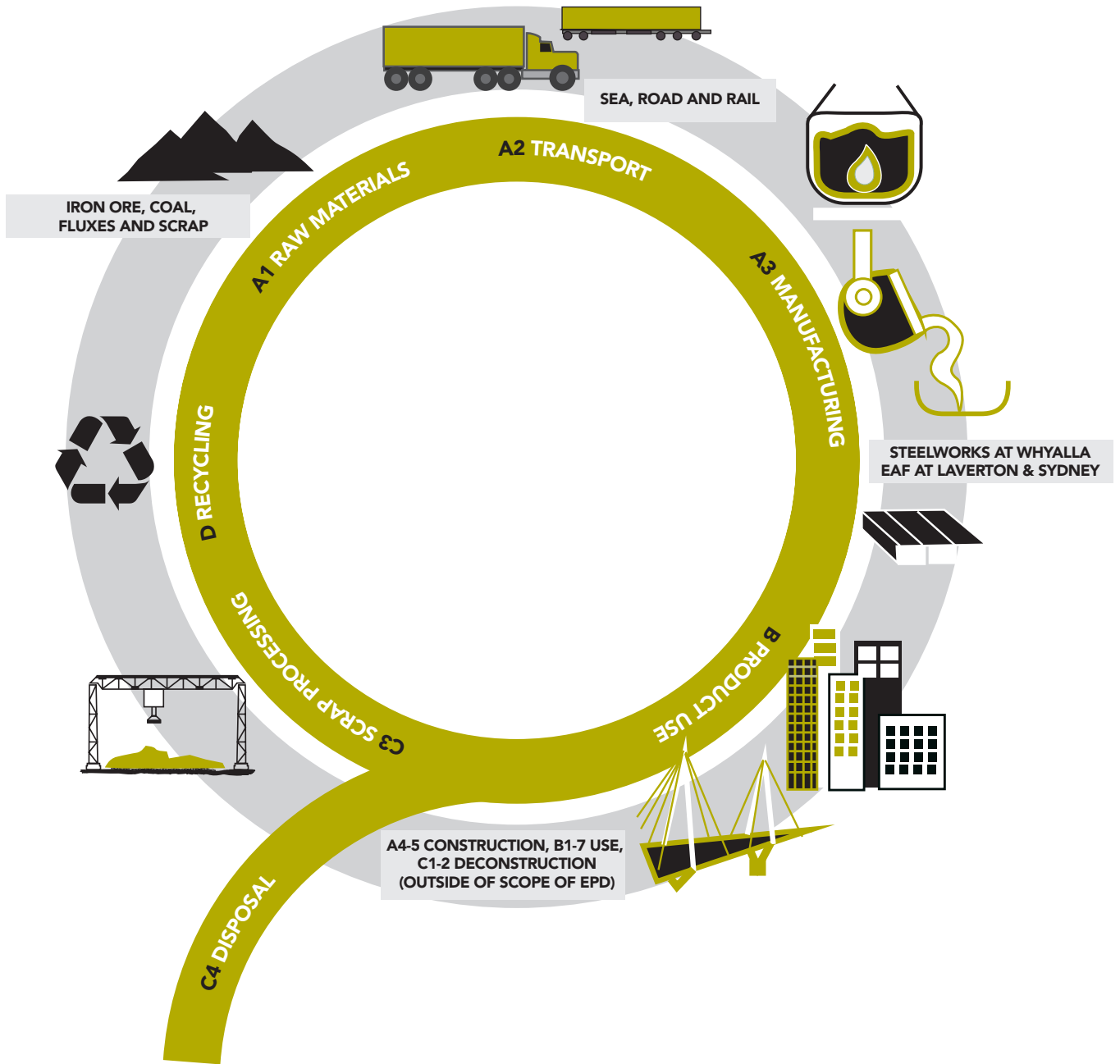
WHY ONESTEEL?

At OneSteel, we understand that sustainability is not just about environmental impact.

We strive to improve our social licence to operate across social, economic and environmental arenas while upholding our core values of customer and safety.

For more information refer to www.onesteel.com

Figure 1
Life cycle of OneSteel products



HOT ROLLED STRUCTURAL AND RAIL PRODUCTS

This EPD includes data on three product groups within the hot rolled structural and rail product category. These include:

1. Structural sections
2. Merchant bar
3. Rail and sleeper sections

Each of the products included in this EPD are available in a wide range of sizes.

All structural and merchant bar products are available in 300PLUS, some in other grades as well.

All structural and merchant bar products conform to the requirements of the relevant Australian and New Zealand standards. All rail products conform to the requirements of the relevant Australian Standards.

Under the United Nations Central Product Classification (UN CPC) system of classification these products fit into two categories:

- 41251 – Angles, shapes and sections, of iron or non-alloy steel, not further worked than hot-rolled, hot-drawn or extruded
- 41253 – Railway and tram track construction material of iron or steel

OneSteel is Australia's only manufacturer of hot rolled structural and rail products.

The products are manufactured by OneSteel at its major steelmaking and processing sites in Whyalla SA, Laverton Vic and Rooty Hill, NSW. The steel products are specific products from one manufacturer (OneSteel), rather than an industry average. A detailed description of the products can be found on pages 14, 17 and 20.

This EPD relates to products manufactured by OneSteel and therefore does not include imported products or components. Conceptually the production process is described below in Figure 2.

STEELMAKING PROCESSES

OneSteel produces steel using two different, but complementary, manufacturing processes. The first process is through an integrated steel mill, which includes key unit processes such as coke manufacture, Blast Furnace (BF) and Basic Oxygen Steelmaking (BOS). This process primarily uses raw materials such as coal and iron ore. The other manufacturing process is the Electric Arc Furnace (EAF) which primarily uses scrap steel and electricity.

These processes are complementary because EAF steelmaking cannot be produced without scrap steel feed that has previously been created through the integrated steel manufacturing process.

Due to this dependency, and because the Australian steel industry already recycles 89% (Hyder Consulting 2012) of available construction, demolition and industrial scrap steel, it is incorrect to consider that recycled content in steel indicates lesser environmental impact or that either of the two steelmaking process (BF/BOS or EAF) is superior to the other.

This interdependency is recognised by rating tools including Green Star® and IS®, in that steel from both processes can contribute equally to obtaining credits under schemes.

Manufacturers and designers alike play a key role in improving the sustainability credentials of steel and steel structures. Designers are encouraged to select the most suitable steel for an application to maximise the efficiency of the design and thus reduce the quantities consumed. As a manufacturer, OneSteel is continually working to provide products and services that are increasingly sustainable, including our higher strength steel solutions that have the capacity to reduce the amount of steel consumed on a project or our innovative steelmaking solutions such as Polymer Injection Technology (PIT).



The typical composition of OneSteel's hot rolled, merchant bar and rail products are;

Iron >98%

Manganese <1.6%

Carbon <0.5%

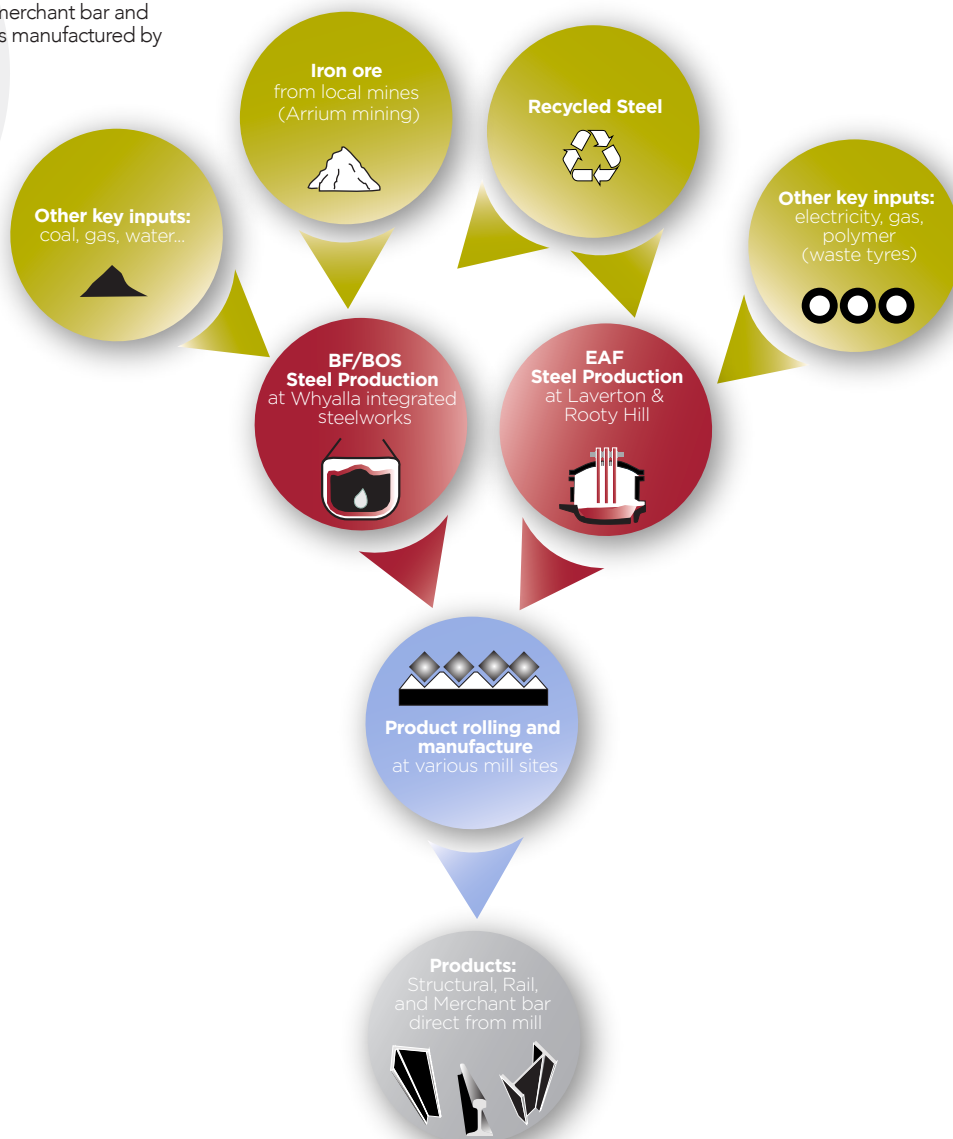
Other <0.5%

A range of alloys are used to manufacture the products and grades represented in this EPD. The use of alloys has been aggregated and averaged in this EPD. The impact of utilising alloys to produce different grades or products has no material impact on the outcome of this EPD.

Products have been grouped such that the variations between the EPD outcomes for individual sections within the same product grouping are deemed as not significant to the EPD result. The upstream manufacturing processes are common across the various products represented within a product group.

The products included in this EPD do not contain any substances of high concern as defined by European REACH regulation.

Figure 2
Structural, merchant bar and
rail products manufactured by
OneSteel



TECHNICAL INFORMATION

DECLARED UNIT

This EPD is valid for a declared unit of one tonne (t) of product ready for dispatch to a customer.

SYSTEM BOUNDARIES

The system boundary of this EPD includes stages A1-A3, C3-C4 and D as shown in Table 1. This scope is referred to as "cradle-to-gate with options".

The production phase of this EPD includes mining of raw materials, transport to, between and within the different manufacturing sites, and manufacturing of semi-finished steel followed by rolling and forming into the final product at the exit gate.

When a structure reaches its end-of-life, the majority of the steel used in the structure is recovered (C3). A recycling rate of 89% has been applied for this EPD (Hyder Consulting 2012). The remaining 11% is assumed to be landfilled (C4).

Module D considers the environmental impact and benefit of steel in its second life cycle.

Information contained in this EPD excludes the use phase environmental impacts of the product which are considered to be too variable to provide meaningful representation.

Table 1: Modules included in the scope of the EPD

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundary	
Raw material supply	Transport of raw materials	Manufacturing	Transport to customer	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to waste processing	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	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	

X = included in the EPD; ND = not declared (such a declaration shall not be regarded as an indicator result of zero).

LIFE CYCLE INVENTORY (LCI) DATA

The Life Cycle Inventory data used in this EPD has been collected and applied according to EN 15804:2012+A1:2013, ISO 14025 and PCR 2012:01 Construction Products and Construction Services v2.0 (2015-03-03) of the International EPD® System.



KEY ASSUMPTIONS

DATA FOR CORE PROCESSES:

Primary (specific) data were collected for all inputs and outputs from OneSteel sites in the production stage (A1-A3). Direct emissions measured based on the Australian National Pollutant Inventory (NPI) scheme were provided by OneSteel for all steel manufacturing sites. Specific information on waste water composition and discharges were provided by OneSteel for processes likely to contaminate the water and therefore require treatment. All data are based on an annual average for the time period July 2013 to June 2014.

DATA FOR UPSTREAM AND DOWNSTREAM PROCESSES:

Secondary (generic) data were used for all raw materials, energy and transport processes, as allowed under the PCR (IEPDS 2015). All data are from the GaBi Life Cycle Inventory Database 2016 and are typically representative of the years 2012 to 2015, depending on the dataset (thinkstep 2016). Australian data were used where possible. Where regional data were unavailable, average data or data from other regions were used.

DATA FOR CREDIT AND BURDEN:

Steel is an internationally traded product, therefore global average data provided by worldsteel Association has been used to calculate the credit or burden for the net recycling of scrap in Module D. This might differ slightly from OneSteel's specific values for some impact categories.

ELECTRICITY MIXES:

Electricity consumption was modelled using state specific grid mixes. The composition of the individual grid mixes was obtained from AusLCI and the background data for the electricity sources (such as coal, wind power, etc.) are based on background data from the GaBi Life Cycle Inventory Database 2016 (thinkstep 2016).

RECYCLING:

When a structure reaches its end-of-life, the majority of the steel used in the structure is recovered. The recycling rate was based on two reports on the waste industry prepared for the Australian Government, which indicate an average recycling rate of 89% for metals in Australia. [Hyder Consulting, 2012].

ALLOCATION:

Where required, co-product allocation using the most relevant physical quantity (mass, volume or energy) was applied for core processes. Where differences in the price of the co-products was large (>25% according to EN 15804, section 6.4.3.2), economic allocation was applied using annual average prices for the time period July 2013 to June 2014. Allocation rules for secondary data (upstream/downstream processes) are documented on the GaBi website (thinkstep 2016). Recycling allocation follows the polluter pays principle in line with EN 15804 and the PCR.

CUT OFF CRITERIA:

Environmental impacts relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary as per the PCR (IEPDS 2015). The only inputs knowingly excluded from the inventory are packaging materials for minor inputs such as alloys, greases, etc., which are used in very small quantities.

ENVIRONMENTAL IMPACT INDICATORS

EN 15804 and PCR 2012:01 v2.0 require the environmental indicators below, calculated based on CML characterisation factors (as updated in 2012).


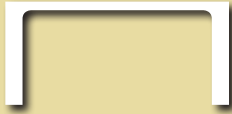
Impact category	Unit	Description
Global warming (climate change) potential	kg CO ₂ equivalent	Potential of greenhouse gases – such as carbon dioxide – to increase absorption of heat reaching Earth’s atmosphere, intensifying the natural greenhouse effect.
Stratospheric ozone depletion potential	kg CFC 11 equivalent	Potential of emissions that contribute to the reduction of the stratospheric ozone layer.
Acidification potential of land and water	kg SO ₂ equivalent	Potential of emissions to cause acidifying effects in the environment, typically due to acid rain. Potential downstream effects include fish mortality, forest decline and the deterioration of building materials.
Eutrophication potential	kg PO ₄ ³⁻ equivalent	Potential of emissions – such as nitrogen and phosphorus – to increase nutrient levels in both aquatic and terrestrial ecosystems, which can cause undesirable shifts in species composition and elevated biomass production (e.g. algal blooms).
Photochemical ozone creation potential	kg C ₂ H ₄ equivalent	Potential of emissions to contribute to air pollution (ground-level smog - mainly ozone), which can be harmful to human and ecosystem health and can also damage crops.
Depletion of abiotic resources (elements)	kg Sb equivalent	Decrease of the availability of non-renewable material resources.
Depletion of abiotic resources (fossil)	MJ net calorific value	Decrease of the availability of non-renewable fossil fuel resources.

The following impact categories have been added to comply with the “Additional Life Cycle Impact Reporting” requirement listed in the “Green Star - Design and As Built” (2014) rating tool from the Green Building Council of Australia.

Impact category	Unit	Description	Methodology
Human toxicity	CTUh	Toxic effects of chemical emissions on human health.	USEtox (Rosenbaum et al. (2008))
Eco toxicity	CTUe	Toxic effects of chemical emissions on eco-systems.	USEtox (Rosenbaum et al. (2008))
Land transformation	m ² land transformed	Land transformed due to agriculture and mining.	Frischknecht & Jungbluth, 2007
Resource depletion - water	m ³ H ₂ O equivalent	Consumption of fresh water related to local and global water scarcity.	Water Stress Indicator (Ridoutt & Pfister (2012))
Ionising radiation	kg U-235 equivalent to air	Radioactive substances released to the environment that can be damaging to human health and ecosystems.	Human health impacts (Frischknecht et al. (2000))
Particulate matter	kg PM2.5 equivalent	Contribution to air pollution which can have respiratory effects.	Riskpoll (Rabi and Spadaro (2004))

STRUCTURAL PRODUCT DESCRIPTION

OneSteel produces the following structural sections, which are made to AS/NZS 3679.1 (Structural Steel Part 1: Hot rolled bars and sections) and are generally used in the construction and manufacturing industries.

Product	Size range (mm)	Section
Equal Angles	125x125x8 to 200x200x26*	
Unequal Angles	150x90x8 to 150x100x12*	
Parallel Flange Channels	150x75 to 380x100*	
Universal Beams	150x75 to 612x229	
Universal Columns	97x99 to 327x311	

**Smaller angle and channel sections are described under merchant bar*

300PLUS is manufactured by OneSteel for hot rolled structural steel sections for Australia and exceeds the minimum requirements of AS/NZS 3679.1 grade 300. Other grades, including grade 350, are available for some sections and quantities.

RESULTS OF ASSESSMENT

Environmental impact indicators

The following indicators describe potential environmental impacts for each product per declared unit.

Table 2: Potential environmental impacts, 1 tonne of structural sections

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
GWP [kg CO ₂ -eq.]	3.2E+03	2.5E+00	5.4E+00	-1.1E+03
ODP [kg CFC11-eq.]	1.6E-08	2.5E-11	2.0E-10	3.6E-05
AP [kg SO ₂ -eq.]	7.1E+00	1.7E-02	1.5E-02	-2.7E+00
EP [kg PO ₄ ³⁻ -eq.]	9.2E-01	4.0E-03	1.9E-03	-7.5E-02
POCP [kg C ₂ H ₄ -eq.]	2.0E+00	2.4E-03	1.7E-03	-6.0E-01
ADPE [kg Sb-eq.]	8.3E-04	4.3E-06	1.0E-06	-3.9E-04
ADPF [MJ]	3.5E+04	4.6E+01	7.7E+01	-1.2E+04

The results from the impact assessment are only relative statements which give no information about the endpoint of the impact categories, exceeding of threshold values, safety margins or risk.

RESOURCE INDICATORS

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

Table 3: Resource use, 1 tonne of structural sections

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
PERE [MJ]	2.0E+03	3.5E+00	5.4E+00	6.2E+02
PERM [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
PERT [MJ]	2.0E+03	3.5E+00	5.4E+00	6.2E+02
PENRE [MJ]	3.5E+04	4.7E+01	8.0E+01	-1.1E+04
PENRM [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
PENRT [MJ]	3.5E+04	4.7E+01	8.0E+01	-1.1E+04
SM [kg]	2.9E+02	0.0E+00	0.0E+00	INA
RSF [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
NRSF [MJ]	8.5E+00	0.0E+00	1.2E-01	INA
FW [m ³]	1.2E+01	1.3E-02	5.7E-04	3.6E-01

WASTES AND OTHER OUTPUTS

Table 4: Waste categories, 1 tonne of structural sections

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
HWD [kg]	4.0E-04	3.3E-06	5.6E-07	1.1E-02
NHWD [kg]	6.4E+02	2.2E-02	1.1E+02	2.6E-03
RWD [kg]	6.3E-02	4.6E-04	1.2E-03	3.8E-01
CRU [kg]	0.0E+00	0.0E+00	0.0E+00	INA
MFR [kg]	3.0E-01	8.9E+02	0.0E+00	INA
MER [kg]	6.6E-01	0.0E+00	0.0E+00	INA
EEE [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
EET [MJ]	0.0E+00	0.0E+00	0.0E+00	INA

GREEN STAR

Table 5: Additional impact categories, 1 tonne of structural sections

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
HTPC [CTUh]	1.5E-06	1.5E-09	1.6E-08	1.9E-08
HTPNC [CTUh]	9.0E-05	3.1E-07	1.6E-06	4.6E-05
LT [m ²]	1.4E+01	2.7E-01	1.7E-01	-3.2E+00
WSF [m ³ H ₂ O-eq.]	7.7E+00	8.8E-03	3.8E-04	2.4E-01
IR [kg U235-eq.]	1.1E+01	4.4E-02	1.6E-01	7.3E+00
PM [kg PM2.5-eq.]	2.7E+00	2.4E-03	1.7E-02	-1.2E-01

MERCHANT BAR

PRODUCT DESCRIPTION

OneSteel produces the following merchant bar products, which are made to AS/NZS 3679.1 (Structural Steel Part 1: Hot rolled bars and sections) and are generally used in the construction and manufacturing industries.

Product	Size (mm)	Section
Equal Angles	25x25x3 to 100x100x12*	
Unequal Angles	65x50x5 to 125x75x12*	
Parallel Flange Channels	75x40 to 125x65*	
Flat Bar (SEF)	20x10 to 150x25	
Square Bar	10 to 40	
Round Bar	10 to 90	

**Larger angle and channel sections are described under structural steel*

300PLUS Steel is the standard grade manufactured by OneSteel for merchant bar. This exceeds the minimum requirements of AS/NZS 3679.1 grade 300. Other grades, including grade 350, are available for some quantities and sizes of angles and channels. Flats, squares and rounds are available in various grades.

RESULTS OF ASSESSMENT

Environmental impact indicators

The following indicators describe potential environmental impacts for each product per declared unit.

Table 6: Potential environmental impacts, 1 tonne of merchant bar product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
GWP [kg CO ₂ -eq.]	1.2E+03	2.5E+00	5.4E+00	1.9E+02
ODP [kg CFC11-eq.]	5.2E-09	2.5E-11	2.0E-10	-6.0E-06
AP [kg SO ₂ -eq.]	5.0E+00	1.7E-02	1.5E-02	4.5E-01
EP [kg PO ₄ ³⁻ -eq.]	4.9E-01	4.0E-03	1.9E-03	1.2E-02
POCP [kg C ₂ H ₄ -eq.]	4.6E-01	2.4E-03	1.7E-03	1.0E-01
ADPE [kg Sb-eq.]	2.4E-04	4.3E-06	1.0E-06	6.5E-05
ADPF [MJ]	1.4E+04	4.6E+01	7.7E+01	2.0E+03

The results from the impact assessment are only relative statements which give no information about the endpoint of the impact categories, exceeding of threshold values, safety margins or risk.

RESOURCE INDICATORS

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

Table 7: Resource use, 1 tonne of merchant bar product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
PERE [MJ]	7.8E+02	3.5E+00	5.4E+00	-1.0E+02
PERM [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
PERT [MJ]	7.8E+02	3.5E+00	5.4E+00	-1.0E+02
PENRE [MJ]	1.4E+04	4.7E+01	8.0E+01	1.8E+03
PENRM [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
PENRT [MJ]	1.4E+04	4.7E+01	8.0E+01	1.8E+03
SM [kg]	1.1E+03	0.0E+00	0.0E+00	INA
RSF [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
NRSF [MJ]	7.2E+01	0.0E+00	1.2E-01	INA
FW [m ³]	5.0E+00	1.3E-02	5.7E-04	-5.9E-02

WASTES AND OTHER OUTPUTS

Table 8: Waste categories, 1 tonne of merchant bar product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
HWD [kg]	3.9E-04	3.3E-06	5.6E-07	-1.9E-03
NHWD [kg]	2.8E+02	2.2E-02	1.1E+02	-4.4E-04
RWD [kg]	4.4E-02	4.6E-04	1.2E-03	-6.3E-02
CRU [kg]	0.0E+00	0.0E+00	0.0E+00	INA
MFR [kg]	5.9E+00	8.9E+02	0.0E+00	INA
MER [kg]	6.7E-02	0.0E+00	0.0E+00	INA
EEE [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
EET [MJ]	0.0E+00	0.0E+00	0.0E+00	INA

GREEN STAR

Table 9: Additional impact categories, 1 tonne of merchant bar product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
HTPC [CTUh]	1.7E-06	1.5E-09	1.6E-08	-3.2E-09
HTPNC [CTUh]	8.9E-04	3.1E-07	1.6E-06	-7.6E-06
LT [m ²]	9.8E+00	2.7E-01	1.7E-01	5.3E-01
WSF [m ³ H ₂ O-eq.]	3.3E+00	8.8E-03	3.8E-04	-3.9E-02
IR [kg U235-eq.]	2.3E+01	4.4E-02	1.6E-01	-1.2E+00
PM [kg PM2.5-eq.]	8.2E-01	2.4E-03	1.7E-02	1.9E-02


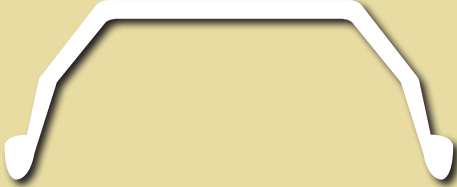
RAIL PRODUCTS

PRODUCT DESCRIPTION

OneSteel produces steel rail suitable for the Australian market in sizes from 41 to 68 kg/m. Rail is produced in accordance with Australian Standard AS 1085.1 (Railway track materials – Steel rails) and various OneSteel Rail Technical Agreement Specifications.

OneSteel produces both Plain Carbon ('As Rolled') and Head Hardened rails.

OneSteel also produces Trak-Lok® steel sleepers that form part of the structure of a railway track.

Product	Size Range (mm)	Section
Rail	137 x 127 to 185 x 152	
Sleeper	258 x 97 to 300 x 122	

The LCA results listed below are applicable to both steel rails and sleepers.

RESULTS OF ASSESSMENT

Environmental impact indicators

The following indicators describe potential environmental impacts for each product per declared unit.

Table 10: Potential environmental impacts, 1 tonne of rail product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
GWP [kg CO2-eq.]	3.2E+03	2.5E+00	5.4E+00	-1.1E+03
ODP [kg CFC11-eq.]	1.6E-08	2.5E-11	2.0E-10	3.6E-05
AP [kg SO2-eq.]	7.1E+00	1.7E-02	1.5E-02	-2.7E+00
EP [kg PO43--eq.]	9.2E-01	4.0E-03	1.9E-03	-7.5E-02
POCP [kg C2H4-eq.]	2.0E+00	2.4E-03	1.7E-03	-6.0E-01
ADPE [kg Sb-eq.]	8.3E-04	4.3E-06	1.0E-06	-3.9E-04
ADPF [MJ]	3.5E+04	4.6E+01	7.7E+01	-1.2E+04

The results from the impact assessment are only relative statements which give no information about the endpoint of the impact categories, exceeding of threshold values, safety margins or risk.

RESOURCE INDICATORS

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

Table 11: Resource use, 1 tonne of rail product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
PERE [MJ]	2.0E+03	3.5E+00	5.4E+00	6.2E+02
PERM [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
PERT [MJ]	2.0E+03	3.5E+00	5.4E+00	6.2E+02
PENRE [MJ]	3.5E+04	4.7E+01	8.0E+01	-1.1E+04
PENRE [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
PENRT [MJ]	3.5E+04	4.7E+01	8.0E+01	-1.1E+04
SM [kg]	2.9E+02	0.0E+00	0.0E+00	INA
RSF [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
NRSF [MJ]	8.5E+00	0.0E+00	1.2E-01	INA
FW [m ³]	1.2E+01	1.3E-02	5.7E-04	3.6E-01

WASTES AND OTHER OUTPUTS

Table 12: Waste categories, 1 tonne of rail product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
HWD [kg]	4.0E-04	3.3E-06	5.6E-07	1.1E-02
NHWD [kg]	6.4E+02	2.2E-02	1.1E+02	2.6E-03
RWD [kg]	6.3E-02	4.6E-04	1.2E-03	3.8E-01
CRU [kg]	0.0E+00	0.0E+00	0.0E+00	INA
MFR [kg]	3.0E-01	8.9E+02	0.0E+00	INA
MER [kg]	6.6E-01	0.0E+00	0.0E+00	INA
EEE [MJ]	0.0E+00	0.0E+00	0.0E+00	INA
EET [MJ]	0.0E+00	0.0E+00	0.0E+00	INA

GREEN STAR

Table 13: Additional impact categories, 1 tonne of rail product

Indicator	Production A1 – A3	Waste processing C3	Disposal C4	Recycling potential D
HTPC [CTUh]	1.5E-06	1.5E-09	1.6E-08	1.9E-08
HTPNC [CTUh]	9.0E-05	3.1E-07	1.6E-06	4.6E-05
LT [m ²]	1.4E+01	2.7E-01	1.7E-01	-3.2E+00
WSF [m ³ H ₂ O-eq.]	7.7E+00	8.8E-03	3.8E-04	2.4E-01
IR [kg U235-eq.]	1.1E+01	4.4E-02	1.6E-01	7.3E+00
PM [kg PM2.5-eq.]	2.7E+00	2.4E-03	1.7E-02	-1.2E-01

ACRONYMS

ADPE	Abiotic Depletion Potential For Non-Fossil Resources
ADPF	Abiotic Depletion Potential For Fossil Resources
AP	Acidification Potential
AusLCI	Australian Life Cycle Inventory Database
BF	Blast Furnace
BOS	Basic Oxygen Steelmaking
CML	Centre Of Environmental Science At Leiden
CRU	Components For Reuse
EAF	Electric Arc Furnace
EEE	Exported Electrical Energy
EET	Exported Thermal Energy
EP	Eutrophication Potential
EPD	Environmental Product Declaration
FW	Net Use Of Fresh Water
Gabi	Ganzheitliche Bilanzierung (German For Holistic Balancing)
GWP	Global Warming Potential
HTPC	Human Toxicity Potential, Cancer Effects
HTPNC	Human Toxicity Potential, Non-Cancer Effects
HWD	Hazardous Waste Disposed
INA	Indicator Not Assessed. A result marked with 'INA' indicates this is unable to be assessed using the worldsteel data set for scrap
IR	Ionising Radiation
ISO	International Organization For Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LT	Land Transformation
MER	Materials For Energy Recovery
MFR	Materials For Recycling
NHWD	Non-Hazardous Waste Disposed
NPI	National Pollutant Inventory
NRSF	Use Of Non-Renewable Secondary Fuels
ODP	Ozone Depletion Potential
PERE	Use Of Renewable Primary Energy Excluding Renewable Primary Energy Resources Used As Raw Materials
PERM	Use Of Renewable Primary Energy Resources Used As Raw Materials
PENRE	Use Of Non-Renewable Primary Energy Excluding Non-Renewable Primary Energy Resources Used As Raw Materials
PENRM	Use Of Non-Renewable Primary Energy Resources Used As Raw Materials
PENRT	Total Use Of Non-Renewable Primary Energy Resources
PERT	Total Use Of Renewable Primary Energy Resources
PM	Particulate Matter
POCP	Photochemical Ozone Creation Potential
RSF	Use Of Renewable Secondary Fuels
RWD	Radioactive Waste Disposed
SEF	Square Edge Flat
SM	Use Of Secondary Material
UN CPC	United Nations Central Product Classification
WSF	Water Scarcity Footprint

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NOTES



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