

Steel – Welded Beams and Columns

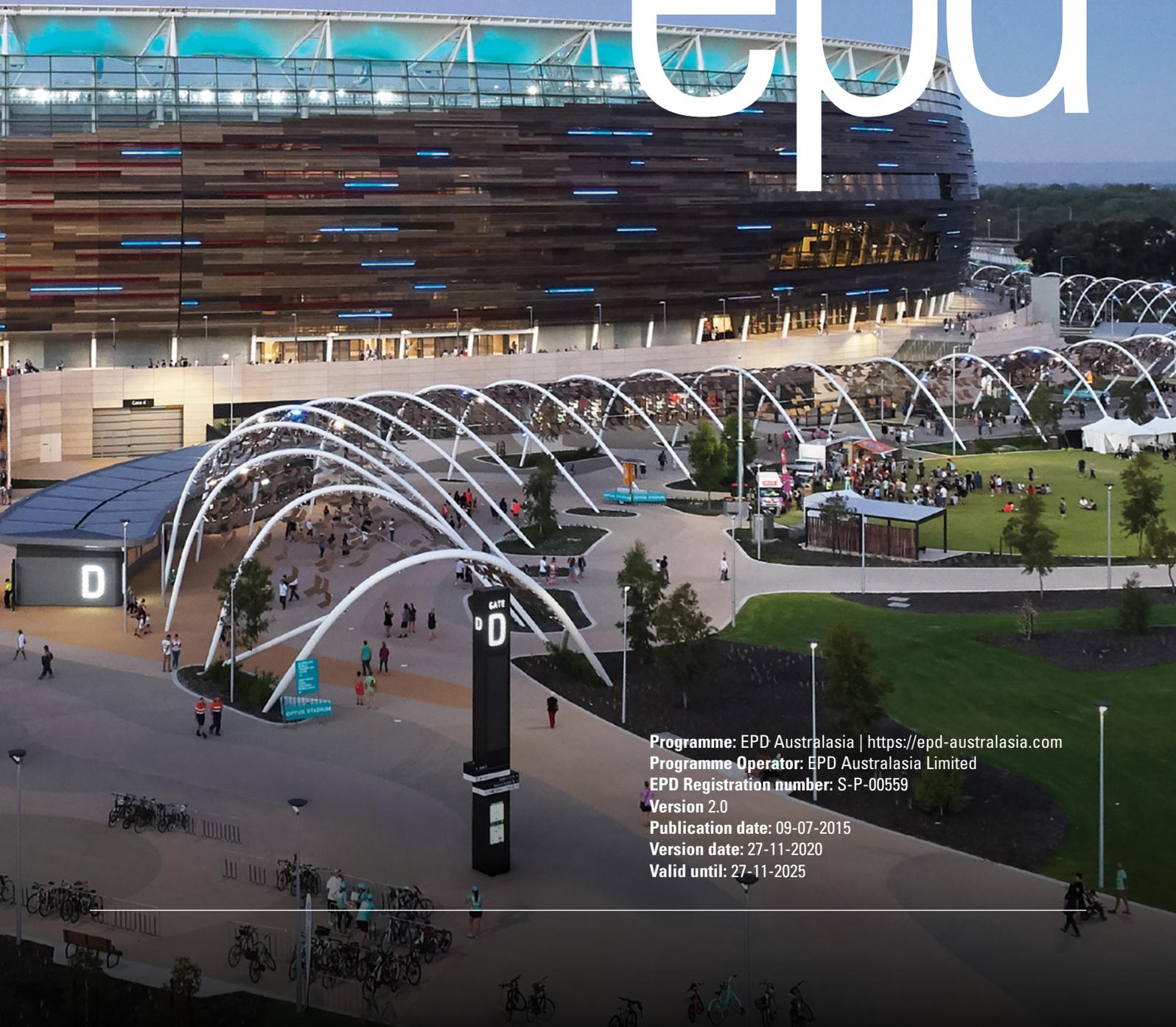
Environmental Product Declaration

In accordance with ISO 14025 and EN 15804:2012+A2:2019



EPD[®]
AUSTRALASIA
ENVIRONMENTAL PRODUCT DECLARATION

epd



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BlueScope Steel Products

Designed for sustainability.

Optus Stadium, Western Australia.
Architect: HASSELL, COX Architecture and HKS Architects

This impressive sports and events facility in Perth has an arresting appearance which makes the most of its magnificent waterfront location. BlueScope supplied all of the primary steelwork – 4,500 tonnes of welded beams

and columns and 3,000 tonnes of XLERPLATE® steel – that was integral to the construction program of the five-level superstructure.

The design reveals exposed columns, beams and pin-joints that express a monumental skeleton supporting vast sections of high-level glazing. This strong and visible framework enables the peripheral circulation spaces to be naturally lit,

and to capture views outwards in all directions. Inside the main arena, a delicate steel framed, lightweight roof canopy provides protection from the elements.

The project was the recipient of The Wallace Greenham Award for Sustainable Architecture at the Australian Institute of Architects' 2018 WA Architecture Awards.



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Key Insights

This EPD provides data for 1 kg of welded beams and columns, manufactured by BlueScope in Australia.

Changes from Previous EPD:

- Published in line with EN 15804:2012+A2:2019: page 4
- Results specific to welded beams and columns, made from Alloyed steel, providing more accurate information: pages 14-15
- The global warming potential of welded beams and columns has decreased over the last 5 years: page 16

Green Star and IS Rating: page 4

- This EPD contributes to the achievement of credits under green building rating schemes.
- Independently verified
 - Cradle-to-gate with modules C1-C4 and module D
 - Product specific
 - Additional Green Star indicators

Recycled Content: page 7

Across the range of steel products manufactured by BlueScope in Australia, including welded beams and columns and all other steel products, the average recycled content¹ in the steel is **17.4%**, which includes pre- and post-consumer recycled materials. Materials reclaimed within the steelmaking, coating and painting operations represent an additional 6.8% average recovered content.

Product Content: page 9

The average composition of 1 kg of welded beam and column steel is:

Product content	Welded beam and column steel (kg)
Steel	1.000
Chemical composition	
Iron	>0.975
Manganese	<0.015
Silicon	<0.003
Carbon	<0.002
Other	<0.005

1. According to recycled content categories defined in ISO 14021:2016. Scrap and iron-bearing materials generated and reclaimed from BlueScope's steelmaking, coating and painting operations represent 6.8% of the product mass, which is not reported as recycled content. Scrap from rollforming and fabrication processes are included as pre-consumer recycled content.



Steel – Welded Beams and Columns Environmental Product Declaration

This EPD sets out information on welded beams and columns manufactured at the BlueScope Welded Products Plant at Unanderra, NSW, from steel made at nearby Port Kembla Steelworks. As the declared unit of 1 kilogram of steel is in mass and the steel product is consistent in composition, any variability in thickness or length has no bearing on the final assessment.

Results for welded beams and columns have been categorised based on their carbon and alloy content as ‘Alloyed steel’. This grade group represents the production-weighted average of a number of similar specific grades of steel, and is representative for those grades. Any differences in composition of steel grades within this group is considered insignificant in relation to the overall results.

This EPD is of the type ‘cradle-to-gate with modules C1-C4 (end of life) and module D (reuse, recovery and/or recycling potential)’. Other life cycle stages are dependent on how the product is used, and should be developed and included as part of a holistic assessment of specific construction works.

Green Star and IS Rating

This EPD contributes to the achievement of credits under green building rating schemes.

- Published in line with EN 15804:2012+A2:2019
- Independently verified
- Cradle-to-gate with modules C1-C4 and module D
- Product specific
- Additional Green Star indicators

Programme:	EPD Australasia www.epd-australasia.com
Programme Operator:	EPD Australasia Limited
Product Category Rules (PCR):	PCR 2019:14 Construction Products, Version 1.0, 2019-12-20 (valid until 2024-12-20)
EPD Registration Number:	S-P-00559
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Valid until:	27-11-2025
Geographical Scope:	Australia

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Steel by BlueScope

We create and inspire smart solutions in steel, to strengthen our communities for the future.

In Australia, BlueScope manufactures steel from raw and recycled materials using an ‘integrated steelmaking’ method. This involves the use of iron ore, coal, steel scrap, fluxes (limestone and dolomite) and alloying materials to produce steel slab via the major processes of sintering, cokemaking, Blast Furnace/Basic Oxygen Furnace (BF-BOF) steelmaking and continuous slab casting, prior to hot rolling into steel plate. The plate is transported to the Welded Products Plant where it is cut and welded to order into beams and columns.

Steel welded beams and columns are manufactured at Unanderra, NSW, from steel made by BlueScope at nearby Port Kembla Steelworks. The manufacturing facilities are accredited to both ISO 9001 (Quality Systems) and ISO 14001 (Environmental Management Systems). BlueScope is a member of the World Steel Association Climate Action Programme, which measures and monitors carbon dioxide emissions.

BlueScope is also a founding member of ResponsibleSteel™, the first global multi-stakeholder standard and certification initiative for the steel industry, which supports the responsible sourcing and production of steel.

BlueScope’s commitment to sustainability is a fundamental theme in Our Purpose: We create and inspire smart solutions in steel, to strengthen our communities for the future.

Our Purpose speaks to why we operate and where we want to be. Our Bond is an expression of our values which recognises our customers as our partners, our people as our strength and communities as our homes. Our Corporate Strategy aims to transform and grow BlueScope, while continuing to deliver on core expectations for our stakeholders.

We are resolute in upholding our social duties to ensure that BlueScope is a safe and environmentally responsible place to work. Our care and commitment to health, safety, environment and community (HSEC) is articulated by our HSEC Policy and is integral to the way we do business.

Our aim is to actively protect the safety and wellbeing of people and minimise the impact of our operations on the local environment and the communities in which we operate.

Our progress and case studies are shared, and can be found in our annual Sustainability Report.

As an Australian manufacturer, we are proud to contribute to local employment and economic growth, and to contribute to the wellbeing and prosperity of our community.

Find Out More

Read more about Our Purpose, Our Bond and commitment to sustainability and HSEC at: <https://www.bluescope.com>

The Future of Steel

At BlueScope, we see a strong future for steel.

Steel is an enabler of the achievement of the United Nations Sustainable Development Goals (SDGs), including SDG 8 Decent work and economic growth, SDG 9 Industry, innovation and infrastructure and SDG 12 Responsible consumption and production and, supported by continued demand, presents a strong opportunity to transition to a low-carbon, circular economy.

Steel’s strength, durability and adaptability make it a material of choice for many different applications in many industries, from buildings to bridges, vehicles to appliances. Steel is also a critical input for the transition to a clean

energy future, being a key material for wind turbines, hydropower and solar power, as well as transmission and distribution infrastructure, among other key assets. However, despite steel products being an important facilitator of the clean energy transition, the production of steel is energy and emissions-intensive.

For the steel sector to contribute to the achievement of the goals of the Paris Agreement, the future of iron and steelmaking will need to be centred around breakthrough steelmaking technology, and whilst there are promising initiatives at various stages of development and commercialisation,

a wholesale shift to near-zero greenhouse gas emission technologies is not anticipated to occur in the near term.

BlueScope has a strong history of innovation, including in environmental impact reduction. We are committed to climate change action, reflected in our corporate strategy and emission reduction targets.

More information on the future of steel and BlueScope’s approach to the climate challenge, can be found in our Sustainability Report: <https://www.bluescope.com/sustainable-steel/reports/>

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Steel can be reused, remanufactured or recycled, supporting the shift towards a circular economy.



Steel and the Circular Economy

Steel is well placed to lead in a circular materials economy – one where resources and materials are kept in use for as long as possible and then repaired, reused, returned or recycled. Steel's recyclability is unmatched by most other material groups, being easily recovered and retaining its valuable properties when transformed into new products.

BlueScope's manufacturing processes are optimised to minimise the use of resources, reduce waste and reuse or convert waste materials into other valuable products.

Along with commercial benefits, maximising resource efficiency prevents resources from

going to waste and supports their use in sectors beyond the iron and steel industry.

Slag is a by-product of steelmaking which, over the years, has transitioned from a waste to a sought-after product. There are two types of slag produced at BlueScope's Port Kembla Steelworks; Blast Furnace Slag and Steel Furnace Slag.

Blast Furnace Slag is a vital input to the cement industry, where it can be used as a substitute for the emissions-intensive active ingredient, clinker. Ground Granulated Blast Furnace Slag can also be used as a partial cement replacement.

Additionally, both Blast Furnace Slag and Steel Furnace Slag are also used as road base material. These applications directly offset the use of quarried materials.

Water is integral to our operations, and water stewardship is a key part of our ongoing licence to operate. BlueScope has a recycled water supply agreement in place with the local authority Sydney Water, significantly reducing demand on local fresh water sources. Port Kembla Steelworks averages over 90% recycled water use (tertiary treated effluent).

Steel and Embodied Carbon

BlueScope supports the Paris Agreement on climate change which states that the global economy must transition to net zero by the middle of this century to limit global increases in temperature well below 2 degrees Celsius.

The achievement of the Paris Agreement requires a transformation in the way steel is produced. While global demand for scrap continues to outstrip supply, the development

and deployment of new low emissions technologies for primary steel production (BF-BOF) while increasing the role of secondary steelmaking (Electric Arc Furnace or EAF), will be key. There is a need to develop a mechanism that identifies and rewards low carbon emissions steelmaking, irrespective of the proportion of scrap or iron ore used as the primary input material.

Such mechanisms would enable users to identify and reward reductions in embodied carbon and efficiencies in manufacturing practices for the steel sector, rather than simply identifying products that use more or less scrap steel. This would create the basis for downstream users of steel to contribute to the achievement of the Paris Agreement through their steel specifying and purchasing decisions, and to reward responsible steelmakers for their own commitment.

BlueScope is a founding member of ResponsibleSteel™, our sector's first global multi-stakeholder standard and certification programme. Initiatives, such as ResponsibleSteel™, are incorporating new methodologies to ensure that the carbon emissions of steel products are calculated on a like-for-like basis, irrespective of the raw materials used and the steel production technology.





Specifying Steel – Recycled Content and Recyclability

Recycled Content

Across the range of steel products manufactured by BlueScope in Australia, including welded beams and columns and all other steel products, the average recycled content² in the steel is 17.4%, which includes pre- and post-consumer recycled materials. Materials reclaimed within the steelmaking, coating and painting operations represent an additional 6.8% average recovered content.

While specifying high recycled content can be an effective way of minimising the environmental impact of many materials, especially those likely to be disposed of at end of life, recycled content is not necessarily a useful metric for steel. This is because the inherent value of scrap steel drives its recovery. In Australia, this is evidenced by a recycling rate for metals of 90%³.

In a global context, where steel demand exceeds scrap supply, the specification of steel products with higher recycled content or produced from

a specific manufacturing method, is therefore unlikely to provide a net environmental benefit, as it does not cause more steel to be recycled.

Focusing on end of life, including ease of recovery e.g. designing for disassembly, is a more effective way of achieving sustainable outcomes with steel products.

Recyclability

Steel's magnetic properties mean that it can be easily separated for recycling. The intrinsic economic value of steel results in a high recovery rate of all steel waste. Scrap merchants are available in all major cities in Australia.

The actual recycling rate of steel at end of life has a significant impact on the cradle-to-grave results. For steel used in construction products, the end of life recycling rate is likely to be higher than the 90%³ used in this assessment, but in specific construction projects may range from 0-100%, depending on individual site circumstances.

Design Considerations

A focus on design is important to minimise the whole of life impact of any construction project. Steel is a strong, durable and versatile material. It lends itself well to structures that are designed for long life, resilience and flexibility to accommodate multiple future reuse options without reinvestment in structural alteration and refurbishment.

BlueScope manufactures a range of standard and high strength steel grades in plate and coil form. High strength steel grades enhance the strength to weight performance in structural steel applications when the design is governed by strength; by maximising the strength grade, a reduced volume of steel would be required in these applications, e.g. columns and primary members. This in turn can result in embodied carbon savings relative to a reference building design that utilises standard steel grades.



Across the range of steel products manufactured by BlueScope in Australia, including welded beams and columns and all other steel products, the average recycled content in the steel is **17.4%**, which includes pre- and post-consumer recycled materials.

2. According to recycled content categories defined in ISO 14021:2016. Scrap and iron-bearing materials generated and reclaimed from BlueScope's steelmaking, coating and painting operations represent 6.8% of the product mass, which is not reported as recycled content. Scrap from rollforming and fabrication processes are included as pre-consumer recycled content.

3. Pickin J et al., National Waste Report 2018, Prepared for the Department of the Environment and Energy; 2018, p. 31.

Steel – Welded Beams and Columns

Environmental Product Declaration

Declared Unit: This EPD is valid for 1 kg of welded beam and column from BlueScope’s Welded Products Plant in Unanderra, NSW.

Product Description

Welded beams and columns are structural steel sections comprising a web and two flanges that have been joined by a deep penetration fillet weld.

They are typically used for the heavier end of the engineering construction, buildings, mining infrastructure and transport market in applications such as office buildings, shopping centres, stadiums, car parks and bridges.

Welded beams and columns enable optimised, high-performance structures. Their dimensional flexibility affords the designer the freedom to create the best design to suit client needs.

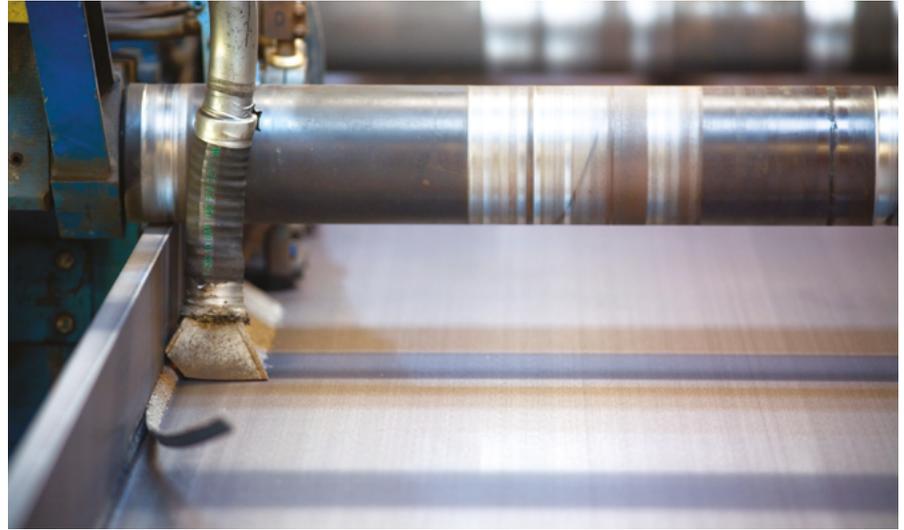
Produced to the Australian Standard AS/NZS 3679.2 and certified by the Australasian Certification Authority for Reinforcing and Structural Steels (ACRS), the product range provides the flexibility to select from our

standard range or customised grades, width, thickness and length to suit your specific design criteria.

Welded beams and columns form part of the following standard classifications: ANZSIC 2741 – Structural Steel Fabricating and UN CPC 41252 – Sheet piling of iron or steel and welded angles, shapes and sections of iron or steel.

A summary of the welded beams and columns product range

Range	350 WC to 1200 WB
Dimensions	41 standard sections. For more details visit http://www.steel.com.au/weldedbeamsandcolumns
Length	Standard lengths between 9 and 18m in 1.5m increments. Other lengths available by enquiry.
Plate Thickness	10mm-40mm
Grades	Standard Grades are G300 and G400 with L15 variants. Other weldable grades available by enquiry.
Cambered Beams	Pre camber available. For more details visit http://www.steel.com.au/weldedbeamsandcolumns
Tolerances	Beam / Column Tolerances as per AS/NZS 3679.2. Plate Tolerances as per AS/NZS 1365.



Product Content

The average composition of 1 kg welded beam and column steel is:

Product content	Welded beam and column steel ⁴ (kg)	Recycled material (pre- and post-consumer) ⁵
Steel	1.000	17.4%, average across the range of steel products manufactured by BlueScope in Australia, including welded beams and columns and all other steel products.
Chemical composition		
Iron	>0.975	–
Manganese	<0.015	–
Silicon	<0.003	–
Carbon	<0.002	–
Other	<0.005	–
Packaging materials	Mass (kg)	Packaging mass (% of product mass)
Timber	0.0146	1.46%

Welded beams and columns are compliant with the European REACH regulation⁶ (EC) 1907/2006 and do not release any hazardous substances when used as recommended. For safe use and maintenance, refer to the product Safety Data Sheet (SDS) available under Technical Documentation at <http://www.steel.com.au/library>.

What is an SDS?

A Safety Data Sheet (SDS) is a document that describes the chemical and physical properties of a product or material and provides safe handling and use information.

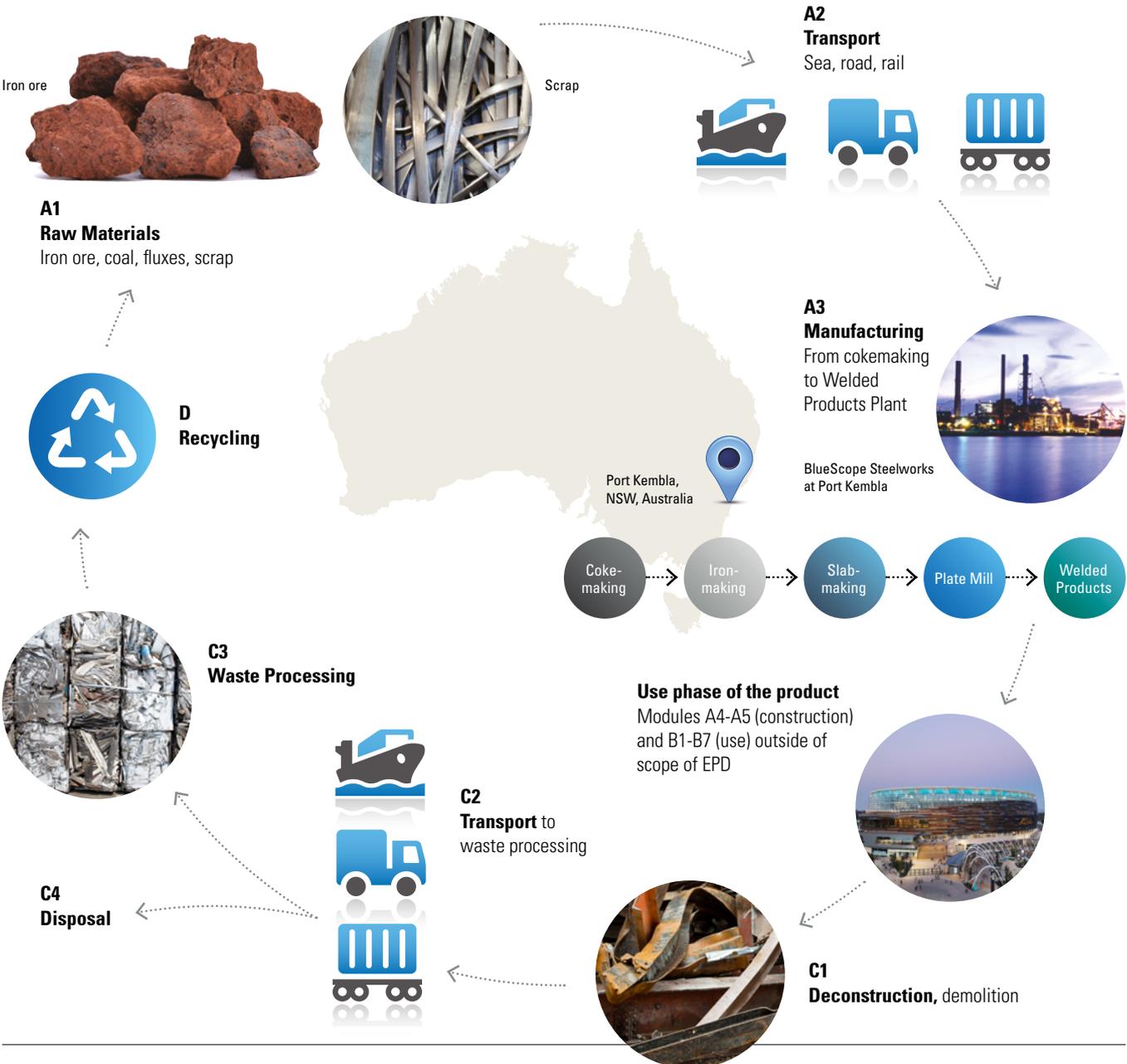
4. Welded beam and column steel products include: AS/NZS 3679.2 grades 300, 300L15, 400, 450L15. Welded beams manufactured to AS/NZS 3679.2, AS/NZS 3678-350 WELDED, 450 WELDED. This list is not intended to be exhaustive. If clarification on a particular product is required, please get in touch by contacting BlueScope Steel Direct on 1800 024 402.

5. According to recycled content categories defined in ISO 14021:2016. The value 17.4% represents the average recycled content across the range of steel products manufactured by BlueScope in Australia, including welded beams and columns and all other steel products. Scrap and iron-bearing materials generated and reclaimed from BlueScope's steelmaking, coating and painting operations represent 6.8% of the product mass, which is not reported as recycled content. Scrap from rollforming and fabrication processes are included as pre-consumer recycled content.

6. Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals.



Welded Beams and Columns Manufacturing in Australia



Steel – Welded Beams and Columns

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Scope of Declaration

The scope of this declaration is according to EN 15804:2012+A2:2019 and is for 1 kg of steel in welded beams and columns from cradle-to-gate with modules C1-C4 and module D. Modules A4-A5 and B1-B7 have not been included due to the inability to predict how the material will be used following manufacture.

The system boundary applied in this study extends from mining of raw materials such as iron ore and coal; transport to and within the manufacturing site; coke, sinter, iron and steel manufacture; ancillary service operations; hot rolling of steel plate, welding into beams and columns and preparation for dispatch to

customers at the exit gate of the manufacturing site.

The system boundary also includes manufacture of other required input materials, the production of external services such as electricity, natural gas and water, and the production of co-product

materials within the steelmaking process, which have been removed by the use of allocation techniques. Wastes and emissions to air, land and water are also included, as are modules C1-C4 (end of life stage), and module D (reuse, recovery and/or recycling potential).

Scope of Declaration in EPD

	Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundary
	Raw material supply	Transport	Manufacturing	Transport	Construction / installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction, demolition	Transport	Waste processing	Disposal	
Modules	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	AU	AU	AU	-	-	-	-	-	-	-	-	-	AU	AU	AU	AU	AU
Specific data	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Steel – Welded Beams and Columns

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Life Cycle Assessment (LCA) Methodology

This EPD has been produced in conformance with the requirements of PCR 2019:14 v1.0 Construction Products, the Instructions of the Australasian EPD Programme v3.0, The International EPD® System General Programme Instructions (GPI) v3.01, and the Australian Green Star Life Cycle Impacts credit.

Primary data were collected for all relevant BlueScope sites in Australia and for all inputs and outputs in the production stage (A1-A3). The original study was based on an annual average for the time period July 2012 to June 2013. This update is based on an annual average for the time period July 2018 to June 2019, for all LCA hotspots covering all inputs with a combined contribution of more than 95% of all main EN15804+A1 impact categories. All direct emissions data was also updated using the average results reported to the National Pollution Inventory over the 3 year period 2016 to 2019. The original data is used for the remaining processes.

All relevant and available data were collected. While cut-off criteria according to the PCR section 4.4 were employed, much data which would have fallen within that scope were included regardless, if available, resulting in a data set which is robust and captures all significant contributors to the LCA results. Use of secondary data (i.e. non process-specific data) was not required within the manufacturing (A3) scope. No carbon dioxide offsetting is included in the EPD.

The secondary data used were procured from the GaBi LCA databases 2020 and hence are less than 5 years old. The electricity supply mix was based on GaBi's state-specific grid mix dataset for NSW (2016-17), which is highly reliant on hard coal (77%), with imports from VIC (6.5%), and QLD (5.6%), and generation from hydro (4.1%), natural gas (3.3%), wind (2.5%), and photovoltaics (<1%). The GWP-total is 1.03 kg CO₂-eq./kWh.

The 'Resource depletion – water' (RDW) indicator requires water scarcity data for the production areas, and these were modelled using the specific watershed scarcity data for the Port Kembla Steelworks.

Where subdivision of processes was not possible, allocation was carried out using the most relevant physical quantity (mass, volume or energy). Economic allocation was applied, using annual average prices for the Australian financial year of 1 July 2018 to 30 June 2019, where the difference in the price of the co-products was large (>25%), including for Gypsum (co-product of sinter), Blast Furnace Slag (co-product of pig iron), and BOS Slag (co-product of BOS steel).

The recycling scenario was based on the National Waste Report 2018⁷ which indicates that the average metals recycling rate in Australia is 90%. This is considered to be a conservative estimate for flat steel construction products, but was used in the absence of verified higher recycling rates.

Key assumptions made in the study were:

- Accuracy of data measurement falls within normal industrial weighing systems accuracy limits of +/-5%.
- Transport of all materials other than major raw materials is insignificant to the overall impacts of welded steel products.
- Upstream data taken from the GaBi LCA database reflects average or generic production and therefore does not correspond to BlueScope's actual suppliers.
- Welded beams and columns belong to the 'Alloyed' steel grade group, which is the production-weighted average of a number of similar specific grades of steel, and is representative for those grades. Any differences in composition of steel grades within a grade group is generally considered insignificant compared to the overall results.

Take care when comparing

Issues to consider when comparing EPD data include:

- Both EPDs must comply with the comparability requirements in EN 15804, e.g. using equivalent methodology and assumptions such as utilising the same Product Category Rules (PCR).

- The results for EN 15804:2012+A1:2013 compliant EPDs are not comparable with EN 15804:2012+A2:2019 compliant studies as the methodologies are different. EN 15804:2012+A1:2013 compliant results are given in this document to assist comparability across EPDs and support use in tools such as Green Star.
- LCA provides high-level scientific guidance and differences in data should be substantial to be material.

- Understanding the detail is important in comparisons. Expert analysis is required to ensure data is truly comparable, to avoid unintended distortions.
- The best way to compare products and materiality of differences is to place them into the context of a structure across the whole life cycle.

Environmental Performance

The potential environmental impact indicators included in this EPD are described in the table below. See the References section for full details on Characterisation Methods. All the result tables from this point will contain the abbreviations only. All results reported in MJ are in net calorific value.

Indicator	Abbreviation	Units	Characterisation Method
Potential Environmental Impact indicators, in accordance to EN 15804:2012+A2:2019			
Global Warming Potential – total	GWP-total	kg CO ₂ -eq.	IPCC 2013 (AR5)
Global Warming Potential – fossil fuels	GWP-fossil	kg CO ₂ -eq.	IPCC 2013 (AR5)
Global Warming Potential – biogenic	GWP-biogenic	kg CO ₂ -eq.	IPCC 2013 (AR5)
Global Warming Potential – land use and land use change	GWP-land use	kg CO ₂ -eq.	IPCC 2013 (AR5)
Depletion Potential of the Stratospheric Ozone Layer	ODP	kg CFC-11-eq.	WMO 2014
Acidification potential	AP	mol H ⁺ -eq.	Accumulated Exceedance
Eutrophication potential – freshwater	EP-freshwater	kg P-eq.	EUTREND model (ReCiPe)
Eutrophication potential – marine	EP-marine	kg N-eq.	EUTREND model (ReCiPe)
Eutrophication potential – terrestrial	EP-terrestrial	mol N-eq.	Accumulated Exceedance
Formation potential of tropospheric ozone	POCP	kg NMVOC-eq.	LOTOS-EUROS
Abiotic depletion potential for non-fossil resources	ADP-minerals & metals	kg Sb-eq.	CML 2002a
Abiotic depletion potential for fossil resources	ADP-fossil	MJ	CML 2002a
Water (user) deprivation potential	WDP	m ³ world-eq. deprived	AWARE
Additional Environmental Impact indicators, in accordance to EN 15804:2012+A2:2019			
Particulate Matter emissions	PM	Disease incidence	SETAC-UNEP, Fantke et al. 2016
Ionising Radiation – human health	IRP	kBq U-235-eq.	Human Health Effect model
Eco-toxicity – freshwater	ETP-fw	CTUe	USEtox
Human toxicity potential – cancer effects	HTP-c	CTUh	USEtox
Human toxicity potential – non-cancer effects	HTP-nc	CTUh	USEtox
Land use related impacts / soil quality	SQP	dimensionless	Soil quality index (LANCA®)
Resource use parameters			
Use of renewable primary energy excluding renewable primary energy	PERE	MJ	n/a
Use of renewable primary energy resources used as raw materials	PERM	MJ	n/a
Total use of renewable primary energy resources	PERT	MJ	n/a
Use of non-renewable primary energy excluding non-renewable primary	PENRE	MJ	n/a
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ	n/a
Total use of non-renewable primary energy resources	PENRT	MJ	n/a
Use of secondary material	SM	kg	n/a
Use of renewable secondary fuels	RSF	MJ	n/a
Use of non-renewable secondary fuels	NRSF	MJ	n/a
Net use of fresh water	FW	m ³	n/a
Waste Categories and Output Flows			
Hazardous waste disposed	HWD	kg	n/a
Non-hazardous waste disposed	NHWD	kg	n/a
Radioactive waste disposed	RWD	kg	n/a
Components for re-use	CRU	kg	n/a
Materials for recycling	MFR	kg	n/a
Materials for energy recovery	MER	kg	n/a
Exported energy – electrical	EEE	MJ	n/a
Exported energy – thermal	EET	MJ	n/a
Additional Potential Environmental Impact indicators, in accordance to EN 15804:2012+A1:2013			
Global warming potential	GWP	kg CO ₂ -eq.	IPCC 2007 (AR4)
Ozone depletion potential	ODP	kg CFC-11-eq.	WMO 2003
Acidification potential	AP	kg SO ₂ -eq.	CML 2002b
Eutrophication potential	EP	kg PO ₄ ³⁻ -eq.	CML 2002b
Photochemical ozone creation potential	POCP	kg C ₂ H ₄ -eq.	CML 2002b
Abiotic depletion potential for non-fossil resources	ADPE	kg Sb-eq.	CML 2002b
Abiotic depletion potential for fossil resources	ADPF	MJ	CML 2002b
Additional Green Star v1.3 indicators			
Land Use	LU	kg C deficit-eq.	Soil Organic Matter method
Resource depletion – water	RDW	m ³	Water Stress Indicator
Particulate Matter	PM	kg PM _{2.5} -eq.	RiskPoll

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Results for 1 kg of Welded Beams and Columns

In accordance to EN 15804:2012+A2:2019

Potential Environmental Impacts							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
GWP-total	kg CO ₂ -eq.	2.84	6.37E-04	0.00470	0.0471	0.00479	-1.25
GWP-fossil	kg CO ₂ -eq.	2.86	6.39E-04	0.00451	0.0471	0.00493	-1.25
GWP-biogenic	kg CO ₂ -eq.	-0.0224	-2.01E-06	1.86E-04	4.23E-05	-1.47E-04	-0.00157
GWP-luluc	kg CO ₂ -eq.	1.04E-04	1.14E-08	8.37E-08	1.13E-05	4.80E-06	3.88E-05
ODP	kg CFC-11-eq.	5.48E-13	8.50E-20	6.26E-19	2.15E-16	1.09E-17	2.85E-15
AP	mol H ⁺ -eq.	0.0103	3.27E-06	1.25E-05	2.26E-04	1.58E-05	-0.00137
EP-freshwater	kg P-eq.	3.75E-07	1.08E-10	7.96E-10	2.19E-08	3.78E-09	-7.21E-07
EP-marine	kg N-eq.	0.00215	1.53E-06	5.46E-06	4.84E-05	3.85E-06	-1.34E-04
EP-terrestrial	mol N-eq.	0.0242	1.67E-05	6.01E-05	5.28E-04	4.23E-05	-0.00103
POCP	kg NMVOC-eq.	0.00730	4.27E-06	1.16E-05	1.34E-04	1.22E-05	-0.00108
ADP-minerals & metals	kg Sb-eq.	5.66E-06	7.85E-12	5.78E-11	3.15E-09	3.33E-10	-3.85E-06
ADP-fossil ⁸	MJ	26.6	0.00849	0.0625	0.521	0.0706	-10.5
WDP ⁹	m ³ world-eq. deprived	0.154	4.07E-06	3.00E-05	0.0179	-5.31E-05	-0.0959

Additional Potential Environmental Impacts							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
PM	Disease incidence	1.29E-07	3.73E-11	8.14E-11	2.30E-09	1.71E-10	-1.86E-08
IRP	kBq U-235-eq.	0.00528	1.09E-07	8.03E-07	1.26E-05	1.19E-04	0.0241
ETP-fw ⁸	CTUe	3.07	0.00301	0.0222	0.0717	0.0210	0.285
HTP-c ⁸	CTUh	2.25E-10	5.16E-14	3.81E-13	4.20E-12	2.42E-12	4.04E-10
HTP-nc ⁸	CTUh	5.50E-08	2.77E-12	1.60E-11	1.54E-10	2.43E-10	-1.31E-08
SQP ⁸	dimensionless	0.961	1.98E-05	1.46E-04	0.0487	0.00534	0.306

Resource use							
Parameter	Unit	A1-A3	C1	C2	C3	C4	D
PERE	MJ	0.587	5.55E-05	4.09E-04	0.0792	0.00494	0.872
PERM	MJ	0	0	0	0	0	0
PERT	MJ	0.587	5.55E-05	4.09E-04	0.0792	0.00494	0.872
PENRE	MJ	26.6	0.00849	0.0625	0.521	0.0706	-10.6
PENRM	MJ	0	0	0	0	0	0
PENRT	MJ	26.6	0.00849	0.0625	0.521	0.0706	-10.6
SM	kg	0.158	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0
FW	m ³	0.00306	7.93E-08	5.84E-07	2.50E-04	9.43E-07	-0.00226

8. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

9. This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and some construction materials, is also not measured by this indicator.

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Waste Categories and Output Flows							
Parameter	Unit	A1-A3	C1	C2	C3	C4	D
HWD	kg	1.52E-08	5.17E-13	3.80E-12	8.43E-11	3.20E-10	-1.43E-06
NHWD	kg	0.0117	1.97E-07	1.45E-06	1.34E-04	0.100	0.133
RWD	kg	4.50E-05	9.00E-10	6.63E-09	8.90E-08	8.36E-07	9.19E-07
CRU	kg	0	0	0	0	0	0
MFR	kg	0.359	0	0	0.900	0	0
MER	kg	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0

End of Life		
Parameter	Unit	Total
Steel collected separately	kg	0.90
Steel collected with mixed construction waste	kg	0
Recovery for re-use	kg	0
Recovery for recycling	kg	0.90
Recovery for energy recovery	kg	0
Disposal to landfill	kg	0.10
Assumptions for scenario	–	N/A

Biogenic Carbon Content	Unit	Quantity
Biogenic carbon content in product	kg C	0
Biogenic carbon content in packaging	kg C	0.00653
Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO ₂		

Additional Results for 1 kg of Welded Beams and Columns

In accordance to EN 15804:2012+A1:2013 and Green Star

Potential Environmental Impacts							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
GWP	kg CO ₂ -eq.	2.75	6.29E-04	0.00464	0.0464	0.00451	-1.19
ODP	kg CFC11-eq.	6.50E-13	1.13E-19	8.35E-19	2.87E-16	1.46E-17	3.80E-15
AP	kg SO ₂ -eq.	0.00840	2.30E-06	8.91E-06	1.85E-04	1.27E-05	-0.00121
EP	kg PO ₄ ³⁻ -eq.	7.73E-04	5.12E-07	1.85E-06	1.66E-05	1.35E-06	-3.35E-05
POCP	kg ethene-eq.	0.00129	2.11E-07	-2.29E-06	9.95E-06	1.18E-06	-5.23E-04
ADPE	kg Sb-eq.	5.65E-06	7.85E-12	5.78E-11	3.15E-09	3.39E-10	-3.84E-06
ADPF	MJ	26.5	0.00849	0.0625	0.520	0.0685	-11.0

Additional Green Star v1.3 Indicators							
Indicator	Unit	A1-A3	C1	C2	C3	C4	D
HTPc	CTUh	2.26E-11	1.54E-15	1.18E-14	1.50E-12	2.11E-13	4.61E-10
HTPnc	CTUh	9.80E-11	5.31E-16	2.61E-15	4.97E-14	5.71E-15	-5.17E-13
LU	kg C deficit-eq.	0.128	1.41E-06	1.04E-05	0.00420	4.70E-04	0.0349
RDW	m ³	0.00201	5.02E-08	3.70E-07	1.67E-04	-1.27E-07	-9.07E-04
IR	kBq U-235-eq.	0.00528	1.09E-07	8.03E-07	1.26E-05	1.19E-04	0.0241
PM	kg PM2.5-eq.	6.77E-04	1.66E-07	4.17E-07	1.25E-05	9.02E-07	-1.08E-04

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Interpretation of Results

The LCA results show that the global warming potential of BlueScope's welded beams and columns has decreased over the last 5 years, due to process improvements and increased efficiencies of scale.

Impact Category Results

The LCA results for global warming (total) are driven by the combustion of energy sources at the steelworks, and the CO₂ emissions resulting from this combustion. The choice of energy sources used in the production process is significant, including the use of the NSW electricity grid. GWP-biogenic and GWP-luluc impacts are negligible compared to GWP-fossil.

Acidification is also driven by combustion of fossil fuels onsite and in upstream generation of electricity, through the release of SO_x, NO_x and other emissions in the combustion processes. Upstream production and transport of raw materials were also important contributors.

The combustion of fossil fuels also drives photochemical ozone formation through the release of nitrogen oxides and carbon monoxide due to incomplete combustion, and eutrophication aquatic marine and eutrophication terrestrial through the release of nitrogen oxides to air.

Eutrophication freshwater was driven by the upstream production of iron ore, and the wastewater emissions from the boilers, through the release of phosphorus and phosphates.

Welded beams and columns are manufactured from the 'Alloyed' grade group, which is dominated by the use of molybdenum oxide (MolyOx) and ferro chrome.

The use of hard coal is the main contributor to the depletion of abiotic resources – fossil fuels, both on-site and in the upstream generation of electricity.

Water use impacts were dominated by the upstream generation of electricity, with significant contributions from the extraction and processing of coal.

Ozone depletion impacts are highly sensitive and were dominated by the release of refrigerants and halons in upstream processes (i.e. secondary data).

While this EPD comprehensively covers the requirements for reporting in the PCR section 5 and Green Star criteria, it is important to recognise that any LCA is not a complete assessment of all environmental or sustainability aspects of the product system under study.

Comparison of the EN15804+A1 Results to Previous EPD

BlueScope has seen increased efficiencies due to process improvements and higher throughputs.

The EN 15804+A1 environmental impact indicator results have been included to enable comparison to the previously published EPD, as well as backwards comparability for sustainability rating tools. The previous EPD for welded beams and columns, published in 2015, contained results for the 'average' steel composition (across all steel grades produced at Port Kembla Steelworks). In this EPD, the results for welded beams and columns are specific to the steel grades used to make welded beams and columns, i.e. 'Alloyed' steel. The 'Alloyed' steel grade group represents the production-weighted average of a number of similar specific grades of steel, and is representative for those grades.

When the results for the Alloyed steel grades are compared with the previous EPD results for 'average' steel, across all steel grades produced at Port Kembla Steelworks, Alloyed steel shows a global warming potential reduction of 3.5% relative to the previous average. When comparing the current average steel composition, across all steel grades produced

at Port Kembla, with the previous average steel results from 2015, it shows a reduction of 7.6%. All indicators show the same trend. Significant decreases were seen for acidification (26%), eutrophication (34%), photochemical oxidation creation (27%), and abiotic depletion of fossil fuels (16%). The decreases for acidification, eutrophication and photochemical oxidation creation are largely due to a change in modelling of the transport of raw materials to better reflect the mode of transport actually used.

The ADPE impact results for Alloyed steel are over two times higher than the original EPD. This is expected since the alloys that have greatest contribution to this indicator are predominantly used in the Alloyed steels.

ODP results decreased by >99% due to updates to the background datasets.

Average Product Assumption – Sensitivity of Results

The life cycle inventory (LCI) gathered, and hence the results in this EPD, are for an annual production-weighted average of a number of similar specific grades of steel, and is representative for those grades. Any differences in composition of steel grades within the 'Alloyed' grade group is generally considered insignificant compared to the overall results.

The results show that depletion of abiotic resources – minerals and metals, and to a lesser extent acidification, is sensitive to alloy content. While the 'Alloyed' grade group is representative for most common alloyed grades, it may not be fully representative for grades with extremely high alloy content. The customer is advised to seek advice from BlueScope if clarification on a particular product is needed by contacting BlueScope Steel Direct on 1800 024 402.



Programme-Related Information and Verification

Programme Operator:	EPD Australasia Limited 315a Hardy Street, Nelson 7010, New Zealand info@epd-australasia.com New Zealand Phone: 09 889 2909 Australia Phone: 02 8005 8206 http://www.epd-australasia.com
EPD Registration Number:	S-P-00559
Publication date:	09-07-2015
Version date:	27-11-2020
Valid until:	27-11-2025
Product Group Classification:	UN CPC 41252 – Sheet piling of iron or steel and welded angles, shapes and sections of iron or steel. ANZSIC 2741 – Structural Steel Fabricating.
Reference Year for Data:	Original study based on 2012-2013 data. Updated to 2018-2019 data for all hotspot processes.
Geographical Scope:	Australia
Standard:	EN 15804:2012+A2:2019 served as the core Product Category Rules (PCR)
PCR:	PCR 2019:14 Construction Products, Version 1.0, 2019-12-20 (valid until 2024-12-20)
PCR review conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña Contact via info@environdec.com
Independent Verification of the Declaration and Data, according to ISO 14025:2006:	<input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification
Third Party Verifier, approved by EPD Australasia:	 Rob Rouwette , start2see Pty Ltd Rob.Rouwette@start2see.com.au
Procedure for follow-up during EPD validity involves third party verifier:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Version History:	v1.0 Initial release. v2.0 Updated in line with 5-year validity, including updated hotspot data covering over 95% of all impacts.

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Mandatory Statements

- This EPD covers life cycle stages A1-A3, plus C1-C4 and D. All other stages are dependent on the specific application of the product and should be included in a whole-of-life model.
- This EPD is verified to be compliant with EN 15804:2012+A2:2019.
- EPDs of construction products may not be comparable if they do not comply with EN 15804:2012+A2:2019.
- EPDs within the same product category but from different programmes or utilising different PCRs may not be comparable.
- BlueScope Steel Limited has sole ownership, liability and responsibility for this EPD.

Contact Information

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Programme Operator	EPD Australasia Limited info@epd-australasia.com
Product Website	http://www.steel.com.au/weldedbeamsandcolumns
BlueScope Manufacturing ISO 14001 Certificate	http://steel.com.au/greentools
Worldsteel Climate Action Programme Membership	http://www.worldsteel.org/steel-by-topic/environment-climate-change/climate-change/Members.html
ResponsibleSteel™ Membership	https://www.responsiblesteel.org/membership/members-and-associates
BlueScope Sustainability Report	http://www.bluescope.com/sustainable-steel/reports
BlueScope Modern Slavery Statement	http://www.bluescope.com/sustainable-steel/reports
BlueScope Community Website	http://www.bluescopeillawarra.com.au

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