Environmental Product Declaration

AUSTRALASIA EPD®
ENVIRONMENTAL PRODUCT DECLARATION

In Accordance With ISO 14025 and EN 15804 for; BarChip MQ58 Macro Synthetic Fibre Concrete Reinforcement from BarChip Inc.

Programme:	EPD Australasia, https://epd-australasia.com/
Programme operator	EPD Australasia Limited
EPD registration number:	S-P-02055
Publication date:	1 December 2020
Valid until:	1 December 2025
Geographical scope of EPD	Global

BarChip Inc.
The Synthetic Fibre Experts
www.barchip.com

Using This EPD

The International EPD® System is a worldwide programme operating in accordance with ISO 14025 for type III environmental declarations and relevant EPDs and PCRs are compliant with European standard EN 15804. They operate a system to verify and register EPDs and maintain a publicly-available library of EPDs and PCRs. Over 1100 EPDs for a wide range of product categories are currently registered by companies in 45 countries.

EPDs may be used in building assessment schemes to quantify the life cycle environmental impacts of the ingoing construction materials. EPDs are suitable for building assessment schemes since they are:

- Based on international standards
- Include the life cycle perspective (cradle-to-gate or cradle-to-grave, depending on the product)
- Cover multiple environmental impact categories
- Are independently verified and aim for comparability within the same product category

Such building assessment schemes include:

Green Building Council Australia

Green Star uses a robust, transparent and independent assessment process, and projects that certify can proudly display the Green Star Certification Trademark. Only projects that have been certified by GBCA can claim to achieve a Green Star rating.

ISCA

The Infrastructure Sustainability Council of Australia (ISCA) is a member-based, not-for-profit peak body operating in Australia and New Zealand with the purpose of enabling sustainability outcomes in infrastructure.

LEED by the US Green Building Council (USGBC) is one of the building assessment schemes that have come the furthest in giving benefits for projects where EPDs are available to encourage the use of products with life-cycle information.

BREEAM®

BREEAM is the world's leading sustainability assessment method for master planning projects, infrastructure and buildings. It recognises and reflects the value in higher performing assets across the built environment lifecycle, from new construction to in-use and refurbishment.

BarChip Inc.

History

Founded in 1962, Hagihara Industries is one of the world's leading manufacturers of woven yarn products.

In 1996, Hagihara began development of one of the first high-performance macro synthetic fibre (MSF) concrete reinforcements, *BarChip M*. Hagihara saw an opportunity to improve the performance of this new technology and decades of plastics extrusion experience enabled Hagihara to design and build new extrusion and cutting machines for this purpose.

In 2000, Hagihara entered into partnership with Elasto Plastic Concrete (EPC) to distribute BarChip internationally. Within a few short years, this partnership produced the revolutionary *BarChip Shogun* fibre. Shogun was the first MSF capable of matching and surpassing the performance of traditional reinforcement in concrete. This performance milestone saw massive growth in the use of BarChip and paved the way for the current generation of high performance BarChip products.

In 2018, EPC was acquired by Hagihara Industries and renamed BarChip Inc. The acquisition allowed BarChip to have complete control of the fibre pipeline, from design and manufacturing all the way to application on the work site.

Today, BarChip is recognised by numerous international standards and guidelines. BarChip is used in nearly every type of concrete application across every continent and is widely recognised as the fibre of choice for demanding applications and major infrastructure projects.

BarChip Inc.
The Synthetic Fibre Experts

HAGIHARA INDUSTRIES INC

Product Information

Product(s) Covered by EPD

This EPD covers the BarChip MQ58 product produced at the BarChip PT Hagihara West Java Industries site in West Java, Indonesia. BarChip MQ58 is manufactured to ISO 9001:2015 and has CE certification. BarChip MQ58 is a macro synthetic fibre used for structural reinforcement in concrete and will last the lifetime of the concrete in which it is cast. The fibres are embossed to provide anchorage with the surrounding concrete matrix, and are added to concrete at the mixing stage to ensure even distribution throughout the mix.

Table 1: Industry classification

Product	Classification	Code	Category
BarChip MQ58 Macro Synthetic Fibre	UN CPC Ver.2	355	Man made fibres. The product falls into two classes 3551 and 3554. These classes are synthetic filament tow and staple fibres as well as artificial filament tow and staple fibres, respectively.

Declared Unit

The results in this EPD are for 1kg of synthetic fibre product used as an additive to concrete for the purposes of concrete reinforcement. The 1kg of synthetic fibre does not include the respective masses of the packaging or optional plastic puck wrappings around bundles of fibres, however, the impacts for such packaging are included.

Content Declaration

Table 2: Content declaration by mass%

Materials / chemical substances	Mass composition (%)	Environmental / hazardous properties
High Density Polyethylene	> 40	None
Virgin Polypropylene	> 58	None
Additives	< 2	None

Packaging

BarChip MQ58 fibres are wrapped in Polyvinyl Alcohol to form bundles referred to as pucks. The wrapping is dissolved during mixing with concrete to release the loose fibres. Pucks are packaged in 5kg paper bags for sale.

The product is not intended to be removed from the paper bag during use, the whole bag, including both paper and fibre product, is added directly to the mixer, where the paper packaging breaks down and becomes part of the final concrete product.

For distribution paper bags are grouped together, wrapped in plastic film and shipped on pallets made from recycled plastic.

Manufacturing Process

BarChip MQ58 is made on a linear production line. All emissions associated with the extrusion, processing and transportation of raw materials are included within this production stage.

Raw materials are mixed and heated in a vat before being extruded, tempered, stretched, embossed, cooled and rolled. The long fibres are then wrapped with Polyvinyl Alcohol before being cut into pucks containing short fibres, then packaged ready for distribution.

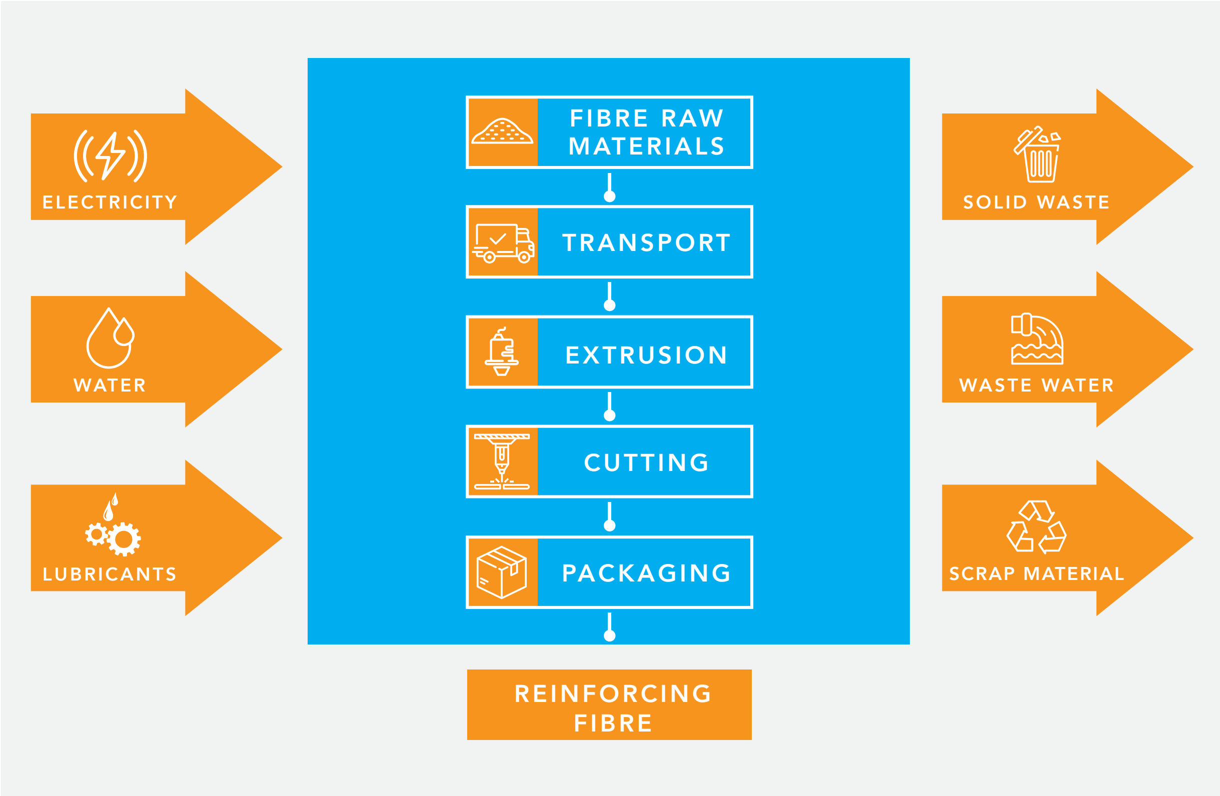
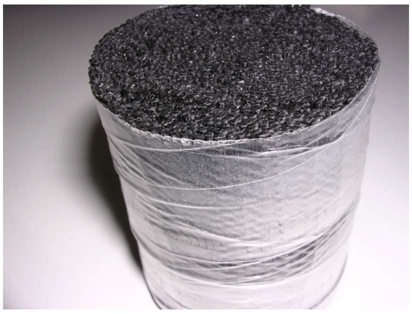
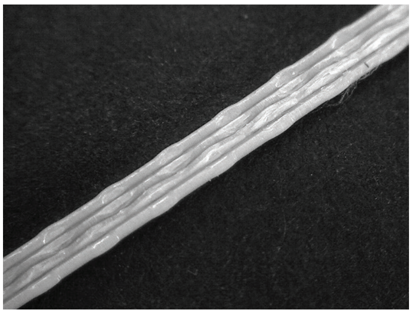


Figure 1: Flow diagram of production system



Puck Packaging



BarChip MQ58 Reinforcing Fibre

Recyclable HDPE Pallets

System Boundaries

As shown in the table below, this EPD is cradle-to-gate. Other life cycle stages (Modules A4-A5, B1-B7, C1-C4 and D) are not declared.

Table 3: 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

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

BarChip MQ58 Reinforcing The BMW Manufacturing Plant, Brazil

Life Cycle inventory (LCI) Data and Assumption

Primary data from the period April 2018 to March 2019 were used for all manufacturing operations up to the factory gate, including for the transport modes and distances of raw materials to the factory.

All data in the background system, including raw material inputs, were from the GaBi Life Cycle Inventory Database 2020 (Sphera, 2020). Most datasets have a reference year between 2016 and 2019 and all fall within the 10 year limit allowable for generic data under EN 15804 (CEN, 2013).

Datasets used for raw material inputs were predominantly Japanese, Indian or Malaysian, which were broadly representative of BarChip's supply network.

Electricity consumed in the manufacturing of the product has been modelled using the 2016 Indonesian grid mix (1kV-60kV) database from Sphera. In 2016 the Indonesian grid mix was 54.5% hard coal, 26.4% natural gas, 7.8% hydro, 6.3% heavy fuel oil, 0.5% biogas and 0.2% biomass with a carbon intensity of 887 gCO_2e/kWh.

Waste

The extrusion and cutting manufacturing steps produce offcuts. All the offcuts from BarChip MQ58 are sent to landfill due to their composite nature making them unsuitable for recycling.

Cut off Criteria

The cut-off criteria for this study includes items which represented less than 1% and summed to less than 5% of the total input of mandatory modules (A1-A3). Furthermore, none of the excluded flows should be of any known particular environmental concern.

The following materials and processes have been excluded:

- Packaging of incoming consumables
- Inbound transport of packaging materials
- Production and disposal off packaging off-cuts that might occur during packaging
- Ink used for printing on packaging materials

All other reported data were incorporated and modelled using the best available life cycle inventory data.

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 (EPD International, 2019a), section 7.5.4.

Allocation

Annual site-wide data was provided for consumption of electricity, water and consumables and disposal of waste. Given the common production process and similarity of products, it is most appropriate to allocate these process impacts based on mass.

No secondary materials are used in the production of the products.

Assessment Indicators

The results tables describe the different environmental indicators for each product per declared unit, for A1-A3. The first section of each table contains the environmental impact indicators, describing the potential environmental impacts of the product as shown in Table 4 . The second section shows the resource indicators, describing the use of renewable and non-renewable material resources, renewable and non- renewable primary energy and water, as shown in Table 5. The final section of each table displays the waste and other outputs, as shown in Table 6.

Table 4: Indicators for life cycle impact assessment

Abbreviation	Unit	Indicator
GWP	kg CO_2 eq.	Global warming potential
ODP	kg CFC11 eq	Ozone depletion potential
AP	kg SO_2 eq.	Acidification potential
EP	kg PO_4^{3-} eq.	Eutrophication potential
POCP	kg C_2H_4 eq.	Photochemical ozone creation potential
ADPE	kg Sb eq.	Abiotic depletion potential for non-fossil resources
ADPF	MJ	Abiotic depletion potential for fossil resources

Table 5: Life cycle inventory indicators on use of resources

Abbreviation	Unit	Indicator
PERE	MJ, net calorific value	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
PERM	MJ, net calorific value	Use of renewable primary energy resources used as raw materials
PERT	MJ, net calorific value	Total use of renewable primary energy resources
PENRE	MJ, net calorific value	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
PENRM	MJ, net calorific value	Use of non-renewable primary energy resources used as raw materials
PENRT	MJ, net calorific value	Total use of non-renewable primary energy resources
SM	kg	Use of secondary material;
RSF	MJ, net calorific value	Use of renewable secondary fuels
NRSF	MJ, net calorific value	Use of non-renewable secondary fuels
FWT	m^3	Total use of net fresh water

Table 6: Life cycle inventory indicators on waste categories and output flows

Abbreviation	Unit	Indicator
HWD	kg	Hazardous waste disposed
NHWD	kg	Non-hazardous waste disposed
RWD	kg	Radioactive waste disposed
CRU	kg	Components for reuse
MER	kg	Materials for energy recovery
MFR	kg	Materials for recycling
EEE	MJ	Exported electrical energy
EET	MJ	Exported thermal energy

The following indicators are not relevant to the studied product system, hence result in zero values:

- Use of renewable primary energy as raw materials (PERM)
- Use of renewable secondary fuels (RSF)
- Use of non-renewable secondary fuels (NRSF)
- Components for re-use (CRU)
- Materials for recycling (MFR)
- Materials for energy recovery (MER)
- Exported electrical energy (EEE)
- Exported thermal energy (EET)

BarChip MQ58 Reinforcing The Toyota Manufacturing Plant, Japan

Results

Potential Environmental Impact

Parameter	Unit	Total A1 - A3
GWP	kg CO_2 eq.	2.50
ODP	kg CFC11 eq.	1.74E-13
AP	kg SO_2 eq.	0.0119
EP	kg PO_4^{3-} eq.	0.00114
POCP	kg C_2H_4 eq.	0.00102
ADPE	kg Sb eq.	1.25E-07
ADPF	MJ, net calorific value	80.6

Use of Resources

Parameter	Unit	Total A1 - A3
PERE	MJ, net calorific value	2.17
PERM	MJ, net calorific value	0
PERT	MJ, net calorific value	2.17
PENRE	MJ, net calorific value	39.6
PRNRM	MJ, net calorific value	41.2
PENRT	MJ, net calorific value	80.8
SM	kg	0
RSF	MJ, net calorific value	0
NRSF	MJ, net calorific value	0
FWT	m^3	0.00935

Waste Production and Output Flows

Parameter	Unit	Total A1 - A3
HWD	kg	1.55E-08
NHWD	kg	0.0428
RWD	kg	7.99E-05
CRU	kg	0
MER	kg	0
MFR	kg	0
EEE	MJ	0
EET	MJ	0

BarChip Inc.
The Synthetic Fibre Experts

Interpretation of Results

Analysis of the results showed that the polymer input materials contribute at least 50% of impacts for Global Warming Potential (GWP), Photochemical Ozone Creation Potential (POCP), Abiotic Depletion Potential of fossil fuels (ADPF) and Abiotic Depletion Potential of elements (ADPE), and also contribute significantly to Eutrophication Potential (EP) and Acidification Potential (AP). Electricity consumption contributes significantly to GWP, AP, EP and POCP. Transport of the raw materials has measurable impacts for AP, EP and POCP. Ozone Depletion Potential (ODP) is dominated by the production of paper used in packaging.

Packaging is a significant hotspot for ODP, but is otherwise a very minor source of impact. The overall ODP results are very low due to the global phase out of ozone depleting substances, which also results in the indicator being highly sensitive.

References

EN 15804:2012+A1:2013; Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products. Brussels: European Committee for Standardization.

EPD Australasia (2018). Instructions of the Australasian EPD Programme: A regional annex to the General Programme Instructions of the International EPD® System. URL: www.epd-australasia.com.

EPD International (2019a). General Programme Instructions of the International EPD® System. Stockholm: International EPD® System. URL: www.environdec.com

EPD International (2019b). PCR 2012:01 Construction Products and Construction Services, Version 2.33, 2020-09-18. Stockholm: International EPD® System. URL: www.environdec.com

ISO 14040:2006; Environmental management – Life cycle assessment – Principles and framework. Geneva: International Organization for Standardization.

ISO 14044:2006; Environmental management – Life cycle assessment – Requirements and guidelines. Geneva: International Organization for Standardization.

ISO 14025:2006; Environmental labels and declarations — Type III environmental declarations — Principles and procedures. Geneva: International Organization for Standardization.

Sphera. (2020). GaBi life cycle inventory database documentation. URL: http://www.gabi-software.com/support/gabi/gabi-database-2020-lci-documentation/

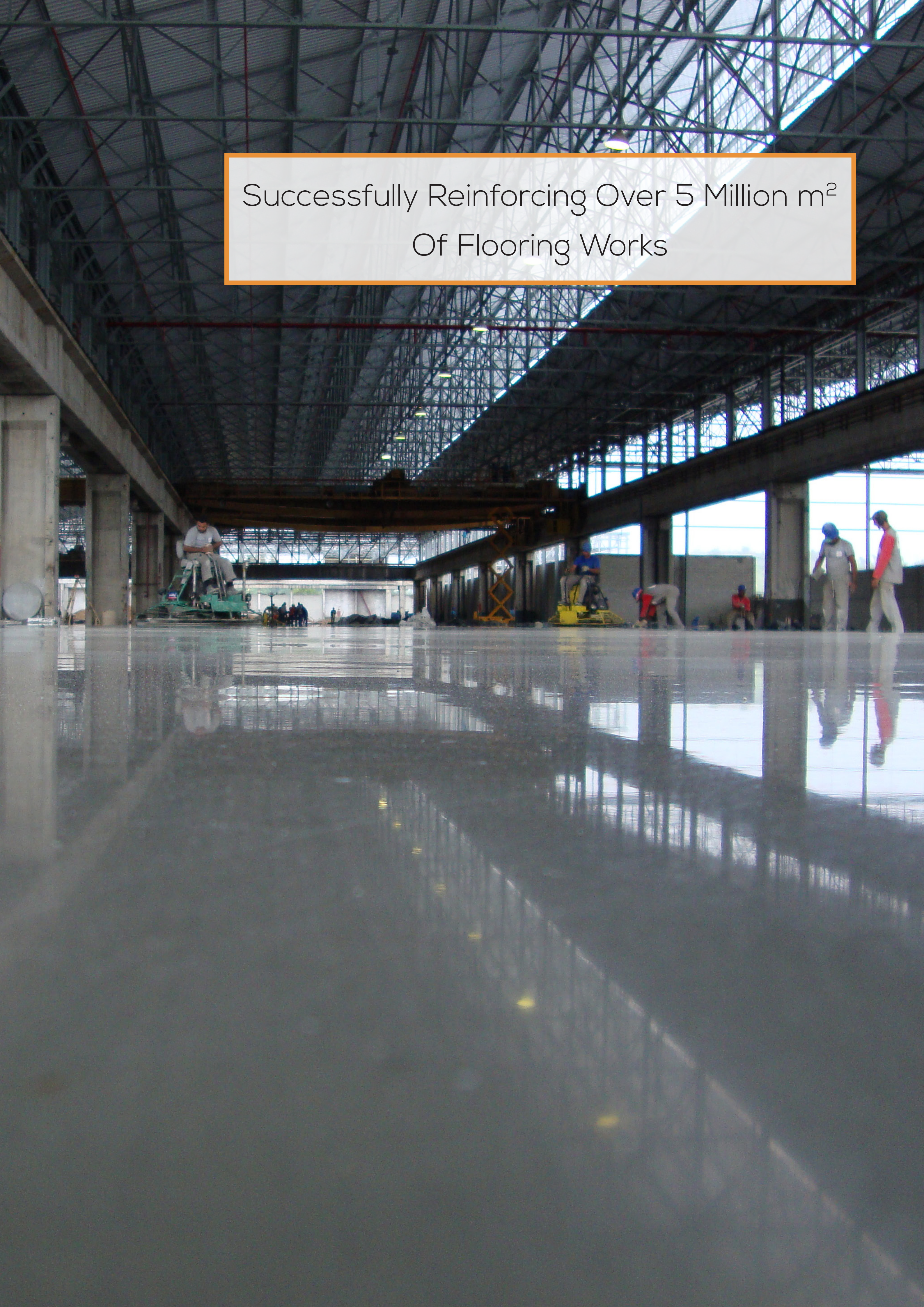
General Information

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Declaration Owner:	BarChip Inc. Web: https://www.barchip.com Email: info@barchip.com Post: Kanda System Building 7F 7 Kanda Konya-cho, Chiyoda-ku, Tokyo, Japan 101-0035
Geographical Scope:	Global
Reference Year of Data	April 2018 - March 2019
EPD produced by:	thinkstep Pty Ltd Web: www.thinkstep-anz.com Email: anz@thinkstep-anz.com Post: 25 Jubilee Street, Perth, Western Australia 6151
EPD programme operator:	EPD Australasia Limited Web: www.epd-australasia.com Email: info@epd-australasia.com Post: EPD Australasia Limited, 315a Hardy Street, Nelson 7010, New Zealand

CEN standard EN 15804+A1 served as the core PCR	
PCR:	PCR 2012:01 Construction Products and Construction Services, Version 2.33, 2020-09-18
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 verification (Internal) ☑ EPD verification (External
Third party verifier:	Andrew D. Moore (Life Cycle Logic) .... Email: andrew@lifecyclelogic.com.au
Verifier approved by:	EPD Australasia
Procedure for follow-up of data during EPD validity involved third-party verifier	☐ Yes ☑ No


Successfully Reinforcing Over 5 Million m^2
Of Flooring Works

BarChip MQ58 Environmental Product Declaration

OUR VISION

BarChip has a simple vision - revolutionise the world of concrete reinforcement. For over 100 years the technology of concrete reinforcement has barely changed. We set out to create a new reinforcement for the 21st century. We created BarChip synthetic fibre reinforcement.

OUR PROCESS

We believe that long term business relationships can only be sustained by a commitment to provide the highest quality products and services. We make sure to understand your concrete, know the performance requirements and work with you to get the right design and the right performance outcomes.

YOUR PRODUCT

When you work with BarChip you know that your concrete asset has been reinforced to the latest engineering standards. It will never suffer from corrosion. It will be cheaper and quicker to build. It will be safer and it will keep performing throughout its entire design life.

BarChip Inc.
info@barchip.com
Australia: +61 1300 131 158
N. America: +1 704 843 8401
EMEA: +353 (0) 1 469 3197
Asia: +65 6835 7716
S. America: +56 2 2703 1563
Brazil: +55 19 3722 2199

Distributors are located in other regions. For contact details visit www.barchip.com.

The Synthetic Fibre Experts

www.barchip.com