

Bamboo X-treme[®]

by Plantation

Bamboo

Sustainable and
certified cladding



**Tested and appraised by BEAL as compliant
with the New Zealand Building Code**



Grotius is a development by Provast,
designed by MVRDV, realised by J.P.
van Eesteren & Besix, photographed
by Daria Scagliola.





Bamboo: the fastest growing plant in the world



certified

durable

fire resistant

sustainable



proven

Since 2008 over
6 million m²
decking and
cladding **installed**,
in more than
60 countries.



High stability,
fast installation and
hidden clip / screw
fasteners

Bamboo X-treme®

With Bamboo X-treme®, our Dutch supplier MOSO® has developed a truly **ecological** and **durable** alternative to increasingly scarce tropical hardwood and non-renewable materials. MOSO® uses a **unique** Thermo-Density® **process** of heat-treatment at 200°C followed by High Density® compression to enhance the **hardness, dimensional stability, fire resistance** and **durability** to a level **superior** to the best tropical hardwood species.

Bamboo X-treme® can be used not only for **outdoor cladding** but also for **outdoor decking, fencing and outdoor furniture**.

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Private Residence Buenos Aires
(100 m²) Buenos Aires, Argentina

from bamboo to Bamboo X-treme®

The fast growth and abundant availability make bamboo a rapidly renewable resource, and a perfect material for many applications in and around buildings. With good reason, it's often called **'the building material of the future'**. However, bamboo as a raw material cannot be used outdoors without a protective treatment. Due to its high "sugar"-components, bamboo is more susceptible to being attacked by micro-organisms and fungi. Let us explain how we get from the raw bamboo material to the final product, Bamboo X-treme®, through a production process called Thermo-Density®.

stem to strands

After harvesting, the mature bamboo stems are split in a longitudinal direction and the outer and inner skins are removed. The strips are then crushed using a number of incision rollers which create cross linked strands. The untreated strands are a light yellow colour.

thermal modification

In several steps, the strands are heated up to 200°C in the presence of saturated steam (to protect the wood from charring or burning) and cooled down. During thermal modification, the moisture content changes and the sugar content is removed from the material. Furthermore, this process changes the colour of the bamboo from white/yellow to deep/dark brown.

from strands to product

The dark bamboo strands are dipped into phenolic glue (< 10% of the weight of the bamboo). After drying, the strands are put into a mould, and are then compressed under high temperature and pressure to cure the glue. The output is a large panel, which is cut into smaller sections (boards or beams). These are then further processed and profiled to become the required shape (for example, for decking: a grooved surface and edge grooves to allow installation with fasteners). As a last step, depending on the customer's request, the boards can be finished.

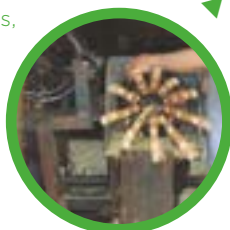
ready to harvest after
4-5 years



modifying the bamboo strands
with a heat-treatment at
200°C



split the Moso
bamboo stems,
remove the
outer skin and
crush the
strips into
strands



compressing
the strands into
Thermo-
Density®
material



creating the final profile
and surface



Bamboo X-treme®:
material more
stable, harder and
stronger than
almost any other
hardwood in the
world!

Thermo-Density®

We call the combination of compressing and thermally modifying the bamboo strands a Thermo-Density® process. It increases the density from 650-700 kg/m³ to approx. 1150 kg/m³ and improves the hardness of this product significantly. After pressing, the material is stronger and harder than almost any other hardwood in the world. At the same time, the dimensional stability of bamboo is improved by approximately 50%.

Besides stability and hardness improvements, the durability is improved to the best durability class possible, from Class 5 to Class 1: Class 1 (EN 350) CEN/TS 15083-2 - simulated graveyard test and Class 1 (EN 350) CEN/TS 15083-1.

durability class according to EN 350 (CEN/TS 15083-2 / CEN/TS 15083-1)

	5	4	3	2	1
Bamboo X-treme®					
Ipé					
Strand Woven Bamboo					
Bangkirai					
Oak					
Scots Pine					

range of
durability
results

Bamboo X-treme® is also well protected against superficial fungi Class 0 (EN 152), and achieves the use/risk Class 4 according to EN 335. MOSO® Bamboo X-treme Cladding is successfully tested and certified against the New Zealand Building Code.

Only MOSO® by Plantation Bamboo can ensure you have the original, unique Bamboo X-treme® product. Other products that attempt to copy the original, do not offer the same quality or level of durability, dimensional stability and ecology. With a look-alike product, there is a large risk of claims after installation. **Always ask for the original, certified MOSO® Bamboo X-treme® products!**

benefits of **Bamboo** X-treme[®] Cladding



hard & durable

- Biological durability Class 1 (EN 350 / CEN/TS 15083-2), simulated graveyard test / Class 1 (EN 350 / CEN/TS 15083-1).
- Use Class 4 in accordance with EN 335.
- Effectiveness against blue stain Class 0 (EN 152).
- Exceptionally hard: Brinell $\pm 9.5 \text{ kg/mm}^2$ (harder than any tropical hardwood available).
- Bamboo X-treme[®] outdoor products have a 25 year warranty.



high stability

- Very stable as a result of a unique Thermo-Density[®] process of heat-treatment combined with High Density[®] compression.
- Far more stable than tropical hardwoods - enabling an end-match system (tongue & groove on ends).
- Limited tendency to torsion.
- No gap between the ends of the boards necessary.



maintenance-free

- Does not require periodic maintenance.
- Choice between natural greying or retaining the brown colour with an exterior finish.



fire resistant

- Achieves fire resistance Class B-s1-d0 (EN 13501-1) without use of fire retardants.
- Achieves flame spread index Class A following ASTM E84.
- As a result, Bamboo X-treme[®] can be easily applied in public projects without additional protective measures.



beautiful appearance

- A beautiful, natural hardwood look.
- Use of hidden clip/screw fasteners avoids face screwing and plugging.
- Free of knots and natural plant resins.



endless resource

- Made from bamboo; with a growing speed of up to 1 meter per day it is the fastest growing plant on earth.
- Ready to harvest after 4-5 years (compared to up to 100 years for hardwood species).
- Consisting of approx. 90% natural bamboo.



CO₂ neutral

- Official LCA and carbon footprint studies (EN 15804) confirm that MOSO[®] Bamboo X-treme[®] is CO₂ neutral during the product lifespan*.
- No use of fungicide in the production.

*) This includes the CO₂ (biogenic carbon - EN 16449) stored in the product.



economical

- Simple and fast installation.
- Reduced waste because of the end-matched connection.
- Cost effective transportation because of the fixed 1850 mm length.

**Tested and appraised by BEAL as compliant
with the New Zealand Building Code**



introduction **Bamboo** **X-treme®** in New Zealand

The Bamboo X-treme® Cladding System is an exterior wall cladding utilising bamboo weatherboards, installed either vertically and/or horizontally. When the Cladding is installed over 10 mm cavity battens and a frame protection system, onto treated timber framing, it provides a medium-weight, highly durable cladding solution suited for residential housing and light commercial buildings.

Bamboo X-treme® Cladding System utilises 18 mm manufactured Bamboo X-treme® weatherboards (1850 mm x 137 mm x 18 mm with effective 128 mm cover), incorporating a tongue and groove style join on the ends of the boards. The clip and screw fixings provided ensure an even space between boards enabling quick and efficient installation.

The weatherboards are fixed to and through the cavity battens, through the underlay or rigid air barrier to the timber framing by way of the proprietary clips that fit into the grooves on either side of the boards. Use of these clips provides a hidden fixing that enhances the aesthetics of the finished cladding.

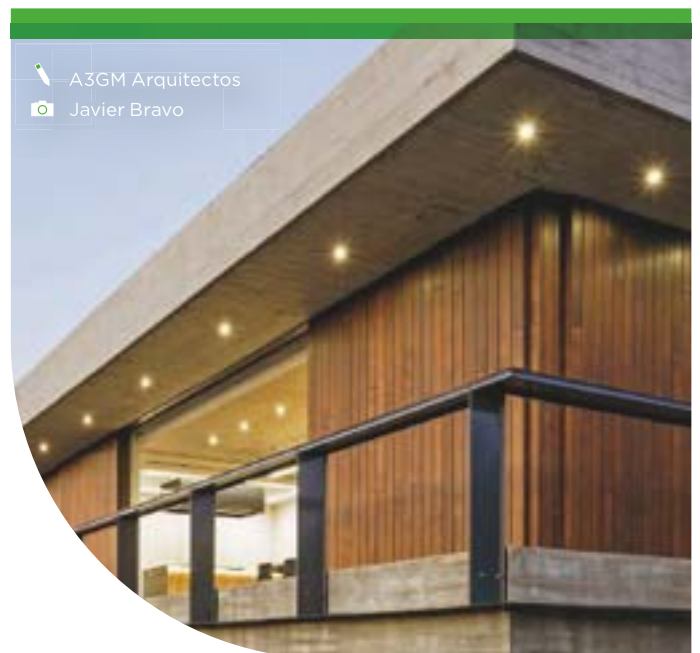
Bamboo X-treme® Cladding System is designed and should be used according to NZS3617:1979 Specification of Profiles of Weatherboards, Fascia Boards, and Flooring.



Compliance with the New Zealand Building Code

The Bamboo X-treme® Cladding System has been tested and appraised by BEAL and complies with the following clauses of the New Zealand Building Code:

- B1 - Structure
- B2 - Durability
- E2 - External Moisture
- F2 - Hazardous Building Materials



For the Technical Manual (and installation instructions) and Building Product Quality Plan go to
www.plantationbamboo.co.nz/bamboo-x-treme-cladding

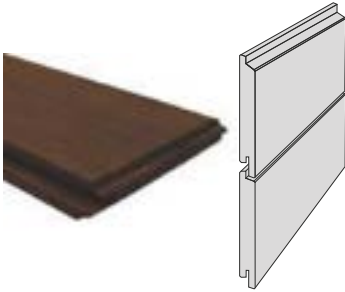
Leisure Space Burgos
Villacienzo, Burgos, Spain

Bamboo X-treme® Outdoor Cladding

Rebated profile

Bamboo X-treme® Outdoor Cladding are solid boards used for exterior applications. The boards are made from bamboo strips that have been compressed and thermally modified at 200°C. MOSO's unique Thermo-Density® process provides Bamboo X-treme® with the highest durability class possible in the appropriate EU norms, increases the stability and density, and consequently the hardness. Furthermore, contrary to other wood products, this material can achieve fire resistance Class B-s1-d0 ¹⁾ (EN 13501-1) without impregnation with expensive and eco-damaging fire retardants. Bamboo X-treme® Cladding with the Rebated profile is made for installation with the stainless steel clip and screw fasteners (18 mm). Like any tropical hardwood species, when exposed to outdoor conditions, Bamboo X-treme® will turn silvery grey over time creating a natural look.

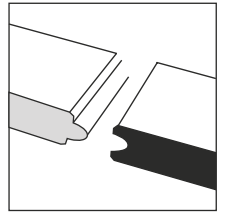
Rebated profile



Clip/screw fastener



End-matched



Product Code	Shape	Finish	Surface	End-matched	Length edges	End edges	Effective width (mm)*	Dimensions (mm)
BO-DTHT500G	Rebated profile	Unfinished	Flat	Yes	R3	2 mm x 45°	128	1850x137x18

*) Effective width with gap that the clips provide.

installation

- Plantation Bamboo guarantees the bamboo material and the mounting materials (fastener/screw) it supplies but does not guarantee the connection with other materials (such as sub frame joist/battens).
- See the Plantation Bamboo Technical Manual for installation instructions at ► www.plantationbamboo.co.nz/bamboo-x-treme-cladding
- Store in a cool and dry place away from direct sunlight, and protected from weather influences, dirt and dust.

technical characteristics and certifications

- Density: ± 1150 kg/m³
- Dimensional stability: length: + 0.1 %; width: + 0.9% (24 hours in water 20°C)
- Resistance to Indentation - Brinell Hardness: ± 9.5 kg/mm² (average value - EN 1534)
- Reaction to fire: Class B-s1-d0 (EN 13501-1) ¹⁾
- Flame spread index: Class A (ASTM E84)
- Thermal emittance: 0.81 (ASTM C1371) ²⁾
- Solar Reflectance (SR): 0.32 (ASTM C1549) ²⁾
- Solar Reflectance Index (SRI): Low 27, Medium 30, High 33 (ASTM E1980) ²⁾
- Modulus of Elasticity: 13565 N/mm² (mean value - EN 408)
- Bending strength: 54.4 N/mm² (characteristic value - EN 408)
- Biological durability: Class 1 (EN 350 / CEN/TS 15083-2), simulated graveyard test / Class 1 (EN 350 / CEN/TS 15083-1)
- Effectiveness against Blue Stain: Class 0 (EN 152)
- Effectiveness against European Termites: Class M (EN 350 / EN 117 - Coptotermes gestroi)
- Use Class: Class 4 (EN 335)
- CO₂ neutral: LCA report TU Delft (ISO 14040/44) (www.moso-bamboo.com/lca)
- Environmental Product Declaration - EPD (EN 15804) (www.moso-bamboo.com/epd)
- Contribution LEED BD+C - v4: MR 1, MR 2, MR 3 (FSC*), SS 7 v2009: MR 6, MR 7 (FSC*)
- Contribution BREEAM: MAT 1, MAT 3 (FSC*), MAT 5 (HD)
- Warranty: 25 years

¹⁾ Tested on 18 mm thickness, without gaps between boards, with ventilation space behind boards.

²⁾ Tested on 3 years weathered MOSO® Bamboo X-treme®.



breeam

Plantation bamboo
Flooring | Decking | Joinery | Cladding



Discover the
full range of
Bamboo X-treme®
on our website



Bamboo X-treme®

test results



The excellent performance of MOSO® Bamboo X-treme® has been extensively tested by acknowledged research institutes. Bamboo X-treme® Cladding has been successfully tested and certified against the **New Zealand Building Code**. Find a summary of the most important test results below. Full reports are available upon request. **Only our Dutch supplier MOSO® can ensure you have the original, unique Bamboo X-treme® product.** Other products that copy the original do not offer the same hardness and level of durability, dimensional stability and ecology. With a look-alike product, there is a large risk of claims after installation. Always ask for the original, certified MOSO® Bamboo X-treme® products!



Durability of MOSO Bamboo X-treme, *Heat Treated Strand Woven Bamboo*: resistance against soft-rotting micro fungi according to CEN/TS 15083-2

Report code: 17.0083-C

Date: 29 March 2017

Page: 8/14

According to EN 350, the durability class is determined based on the x-value. To calculate the x-value, the median mass loss or the test species is compared to the median mass loss of the Beech or Pine references. Hardwoods are compared to Beech, Softwoods are compared to Pine. As Bamboo is neither softwood nor hardwood a comparison is made with both reference wood species Pine sapwood and Beech.

Based on the mass loss found and the comparison to Beech and Pine, the tested MOSO Bamboo X-treme, *Heat Treated Strand Woven Bamboo*, can be classified in durability class 1 when using the method described in EN 350.

MOSO Bamboo X-treme, *Heat Treated Strand Woven Bamboo*, performs comparable to Azobé and Merbau. Little variance is found between the different boards.

durability

CEN/TS 15083-2
(ENV 807) /
EN 350

class 1



Durability of het treated strand woven bamboo: resistance against degradation by Basidiomycetes according to EN 350 and CEN/TS 15083-1

Report code: 17.0083-B

Date: 29 March 2017

Page: 8/14

According to EN 350, the durability class is calculated based on the mass loss obtained with the fungus resulting in the highest median mass loss. For all fungi the mass loss is less than 5%. This implies that, when using the EN 350 to determine the durability, MOSO Bamboo X-treme, *Heat Treated Strand Woven Bamboo* can be classified in durability class 1.

durability

CEN/TS 15083-1
(EN 113) /
EN 350

class 1



Resistance of Heat Treated Strand Woven Bamboo against blue staining fungi

Report code: 9.061-E

8 September, 2009

Page: 10/10

4 Conclusion

On behalf of Moso International BV an EN 152 blue stain test was performed on Heat Treated Strand Woven bamboo. UV- weathering was used as preconditioning of part of the samples. The combination of UV light and water spray resulted in strong discoloration of the surfaces of both the bamboo samples and the Pine sapwood reference samples.

Neither on the weathered nor on the original Bamboo samples discoloration of the blue stain fungi or the hyphae of the blue stain fungi could be observed. As a result it can be concluded that the susceptibility of this Heat Treated Strand Woven Bamboo towards blue stain is very low.

resistance against blue staining fungi

EN 152

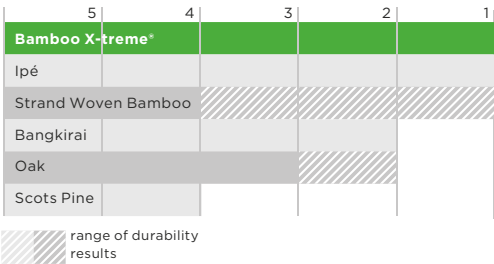
class 0

harder and more durable than almost any other hardwood

durability class

class 1

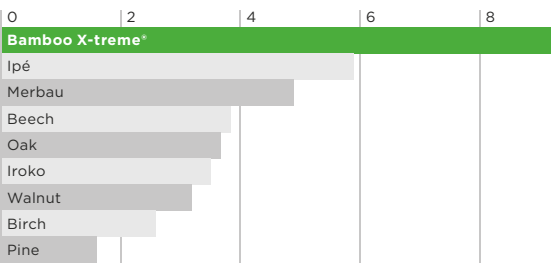
(EN 350 (CEN/TS 15083-2 / CEN/TS 15083-1)



average brinell hardness

± 9.5 kg/mm²

(EN 1534)



Classification Durability Class

Use Class	1. very durable	2. durable	3. moderately durable	4. slightly durable	5. not durable
1 interior	o	o	o	o	o
2 moist interior	o	o	o	(o)	(o)
3 exterior, above ground	o	o	(o)	(o)-(x)	(o)-(x)
4 ground contact / fresh water	o	(o)	(x)	x	x
5 salt water	★	(x)	(x)	x	x

- o Natural durability sufficient.
- (o) Natural durability normally sufficient, but for certain end uses treatment may be advisable.
- (o)-(x) Natural durability may be sufficient, but depending on end use, preservative treatment may be necessary.
- (x) Preservative treatment is normally advisable.
- x Preservative treatment necessary.
- ★ Natural durability of Bamboo X-treme* not tested in salt water.

Efectis	Elertis Nederland BV 2013 Efectis 80227 (Rev.2) February 2020 MOSO International BV	CLASSIFICATION
4.2 CLASSIFICATION		
The product, MOSO® Bamboo X-treme , in relation to its reaction to fire behaviour is classified:		
B		
The additional classification in relation to smoke production is:		
s1		
The additional classification in relation to flaming droplets / particles is:		
d0		
Reaction to fire classification: B – s1, d0		

Classification ASTM E84

Classification	Flame Spread Index	Smoke Developed Index
A	0 - 25	0 - 450
B	26 - 75	0 - 450
C	76 - 200	0 - 450

Carbon footprint (kg CO₂ eqv.) per m² during product lifespan

CSC*	PRODUCTION**	TRANSPORT	TOTAL
-31,84	24,457	5,198	-2,185

Carbon footprint (kg CO₂ eqv.) per m² after incineration

CSC RELEASED	END OF LIFE***	TOTAL
31,84	-6,003	23,65

* Construction Stored Carbon
** Production includes all elements of making 1 m² of product, such as the raw materials, transportation to factory, production processes, waste.
*** End of Life takes all elements of the end of life into consideration, such as the credit received for energy recovery as well as the negative impact of incineration.
In line with circular economy principles, MOSO® always recommends trying to upcycle or repurpose your bamboo products at the end of their life and looks at incineration as a worst case scenario. In 2021 MOSO® fully investigated bamboo incineration for green energy production together with Renewi (Dutch waste company) and confirmed that MOSO® Bamboo Products are classified as B grade wood (in the Netherlands) and can be safely burnt in an incineration plant for energy recovery.



The life cycle and the carbon footprint of MOSO® Products are evaluated according to ISO 14040/44.
For more information: www.moso-bamboo.com/lca
The full report is available on request.
Confidential - This information is the property of Moso International BV, Zwaag, the Netherlands. Any use or reproduction without permission will be prosecuted.

experts in
sustainability
nibe

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durability

EN 350 (CEN/TS 15083-2 / CEN/TS 15083-1)

class 1

use/risk class

EN 335

class 4

fire resistance

EN 13501-1

class B-s1-d0

reaction to fire

(FSI 25 / SDI 45)

ASTM E84

class A

WUI approved

CAN/ULC-S102

carbon footprint

ISO 14040/44

CO₂ neutral

the sustainability of Bamboo X-treme®

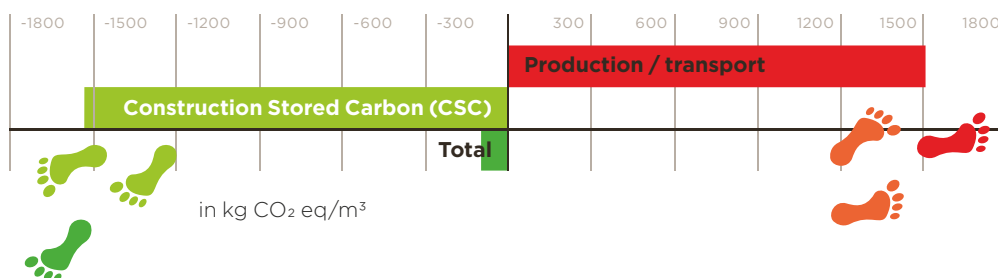
Bamboo X-treme® offers clear sustainable advantages and is even proven to be CO₂ neutral during the product lifespan! The inclusion of Bamboo X-treme® contributes to a higher LEED, BREEAM, Green Star, HQE and DGNB certification score for green building projects. That's one of the reasons why you can find MOSO® Bamboo X-treme® and other MOSO® Products in many sustainable reference projects all over the world.

carbon footprint

Bamboo X-treme®: CO₂ neutral during the product lifespan*

MOSO® has conducted several LCA studies, including carbon footprint studies, together with Delft University of Technology (TU Delft) and NIBE (LCA experts). The 2015 LCA report, available at www.moso-bamboo.com/lca, was the first of its kind and resulted in many new findings about the carbon footprint of bamboo products. The environmental impact of MOSO® Bamboo Products, excluding the carbon sequestration effect, has also been published in 2016 and updated in 2022 in an official Environmental Product Declaration (EPD) following EN 15804 (www.moso-bamboo.com/epd).

*) This includes the CO₂ (biogenic carbon - EN 16449) stored in the product.



The Gas Museum

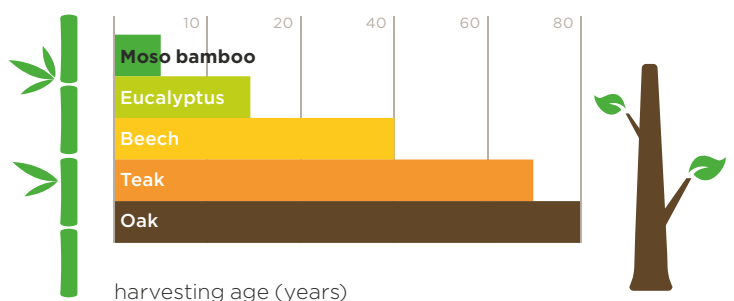
(700 m²) Sabadell, Barcelona, Spain



unsurpassed growing speed

bamboo: the fastest growing plant in the world

Because of the fast growth, Moso bamboo is managed as an agricultural crop: the annual harvest of the 4 to 5-year-old stems - compared to 60-80 years for tropical hardwood! - provides a steady annual income to farmers and stimulates the bamboo plant to reproduce even faster. Therefore, by default, no deforestation occurs with production of Bamboo X-treme®, while large amounts of CO₂ are captured in the bamboo forests and products (www.inbar.int/understanding-bamboos-climate-change-potential).

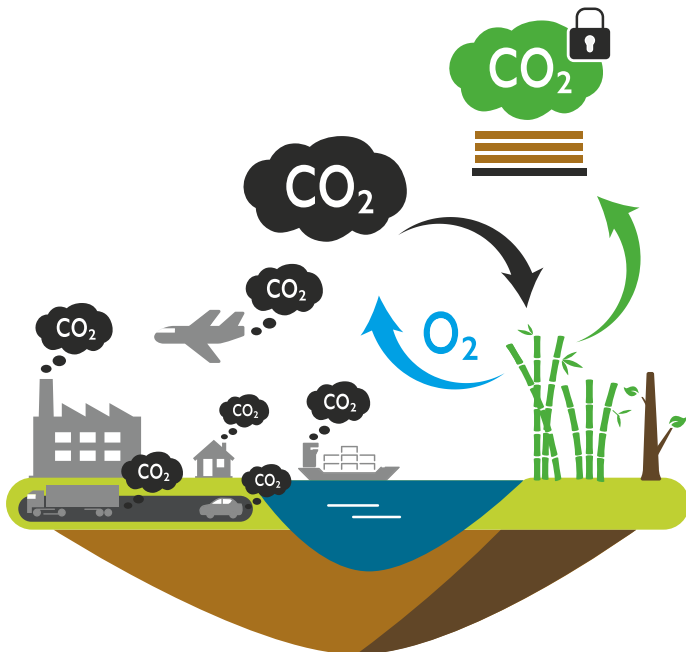




carbon storage in bamboo

biobased materials act as CO₂ sinks

Through photosynthesis, plants absorb carbon dioxide (CO₂) and convert it into glucose (building block for biomass) and oxygen. The CO₂ is stored in the material for the lifetime of the product, and even longer if the product is recycled into new, durable products. Due to the fast growth – and related high yields – Moso bamboo locks far more CO₂ in durable products compared to wood species. The locked amount of CO₂ can be calculated rather simply by looking at the density of the material and taking into account the biobased content. For example, Bamboo X-treme® locks almost 1.660 kg CO₂ per m³ of bamboo, which is the equivalent of the CO₂ emissions of 14.000 km driven by a mid-range car.



Check out how bamboo can save the world at:
www.moso-bamboo.com/sustainability

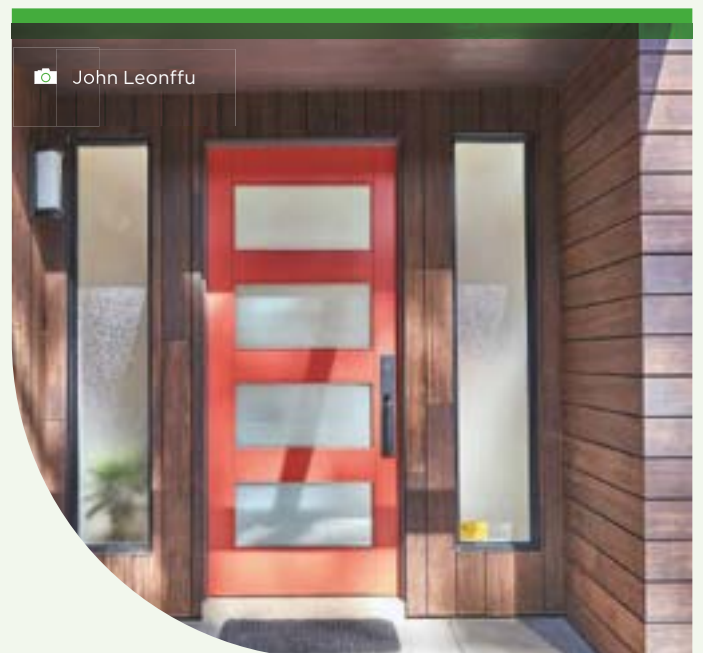


Notiz Hotel NHL Stenden - Green Key Award Gold
 (1200 m²) Leeuwarden, the Netherlands



BRT Architecten
 Awood
 Ronnie Zeemering

*Contributes to a higher
 score for green building
 projects worldwide*



John Leonffu

Private residence Del Mar
 California, United States of America

Bamboo X-treme®

Outdoor Cladding

user information

appearance and colour

Bamboo X-treme® is a natural product, which can vary in colour, grain and appearance. Colour will change over time depending on the maintenance schedule. The boards have a brown to dark brown colour when installed, which turns into a lighter caramel colour several weeks after installation. Without further maintenance the colour gets greyish relatively fast (similar to most other wood species).

If a brown colour is preferred, maintenance should be done with an exterior finish. For further details see the installation instructions.

Bamboo X-treme® shows similarity to other hardwoods in grain and structure. The characteristic bamboo nodes however can still be recognised and provide the product with a special and lively look.

normal phenomena

Cracks on the surface and on the ends of the boards can occur due to the different drying characteristics of the surface and board ends. This does not affect the stability or durability of the board.

The surface side of the boards will become rougher over time and can form (small) splinters as a result of continuous water absorption and desorption due to dry and wet weather periods. Dimensional change or cupping of the boards can occur after installation. These phenomena are normal for most hardwood species and Bamboo X-treme®.

After installation, there might be some bleeding or leaching of colour from the bamboo material when it gets wet, e.g. when it rains. This possible bleeding is typical for wood and will disappear over time. The brownish liquid can easily be cleaned from the Bamboo X-treme® material, however controlled water drainage and prevention of splash water is required to prevent any discoloration of surrounding or underlying building components.



Luxurious garden Cladding installed with Grad's invisible rail installation system - Arnhem, the Netherlands



Endless
possibilities with
MOSO® Bamboo
X-treme®



Housing project De Krijgsman Cladding meets the highest fire safety requirements - (320 m2) Muiden, Netherlands

Since 2008 over
6 million m² decking
and cladding installed in
more than 60 countries

Moke Architects
MOSO®

Public Elementary School "IKC" Photo taken 5 years
after installation - (320 m²) Amsterdam, The Netherlands



More information about **Bamboo X-treme® Cladding**
by **Plantation Bamboo** at:
www.plantationbamboo.co.nz/bamboo-x-treme-cladding





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with the New Zealand Building Code**

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Peter Brugmans Fotografie

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Mastering
bamboo