

MOSO® Bamboo

N-durance® & X-treme®

Certified, sustainable
and beautiful
outdoor products



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



MOSO®

Bamboo Decking

With Bamboo X-treme®, 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. MOSO® Bamboo X-treme® can be used for **outdoor decking, cladding, fencing and outdoor structural builds.**



Bamboo: the fastest growing plant in the world



"With **MOSO® Bamboo**

*we use the latest technologies
to produce a product that
doesn't only perform in terms of
stability and durability, but also
has a warm, natural appearance
which is appreciated by so
many people"*

René Zaal, CEO Moso International BV

table of contents

from bamboo to **MOSO® Bamboo N-durance®**
benefits

MOSO® Bamboo N-durance® Outdoor Decking
accessories
installation
maintenance & cleaning

MOSO® Bamboo X-treme® Outdoor Decking
user information
test results
sustainable choice

from bamboo to Bamboo decking

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, MOSO® Bamboo X-treme® & N-durance®, 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



MOSO® 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)



MOSO® 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.

Only MOSO® 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!**

MOSO® Bamboo decking benefits



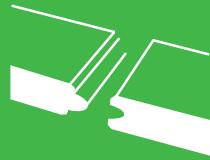
beautiful & elegant

- A warm caramel colour.
- Natural, high quality look.
- Choice between flat / grooved reversible board or the curved surface board.
- Use of hidden fasteners avoids face screwing and plugging.
- Yearly maintenance is required to retain the caramel colour and ensure a luxurious appearance.



hard & durable

- Exceptionally hard: Brinell $\pm 9.5 \text{ kg/mm}^2$ (harder than any tropical hardwood available).
- Very high density: $\pm 1200 \text{ kg/m}^3$.
- Bamboo N-durance® with Durability Class 1 according to EN 350 / CEN/TS 15083-2, simulated graveyard test / Class 1 according to EN 350 / EN 113-2 (CEN/TS 15083-1).
- Use Class 4 in accordance with EN 335.
- Strong fungi resistance according to EN ISO 846, after superficial treatment (tested on new material).
- MOSO® gives Bamboo N-durance® Decking 25 years warranty.



high stability

- Very stable as a result of a unique Outdoor-Density® process: crushing, carbonisation under high pressure and compression.
- Far more stable than tropical hardwoods - enabling an end-match system (tongue & groove on ends).
- Limited tendency to warp.
- No gap between the ends of the boards necessary.
- Only 5-6 mm space between the boards when MOSO® Fasteners are used.



fire resistant

- Achieves fire resistance Class Bfl-s1 (decking) and B-s1-d0 (beams) following EN 13501-1 without the use of fire retardants.
- As a result, MOSO® Bamboo N-durance® can be easily applied in public projects without additional protective measures.



easy to install

- Can be installed using hidden fasteners (edge grooved) or face screwed.
- Both sides of the board - grooved or flat - can be used.
- Fixed board length 1850 mm, easy for 1 person to install, no complicated installation plans necessary.
- MOSO® Fasteners make it easy to install and uninstall.
- End-match system simplifies the installation by allowing the joint to float between the joists.
- MOSO® Bamboo X-treme® Sub frame joists available.



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).
- Engineered product consisting of 83% natural bamboo strands.



economical

- Simple and fast installation; up to 30% savings in installation costs!
- Reduced waste because of the end-match system.
- Cost effective transportation because of the fixed 1850 mm length.
- Cost effective and space reducing stocking because of unique multi usable board.

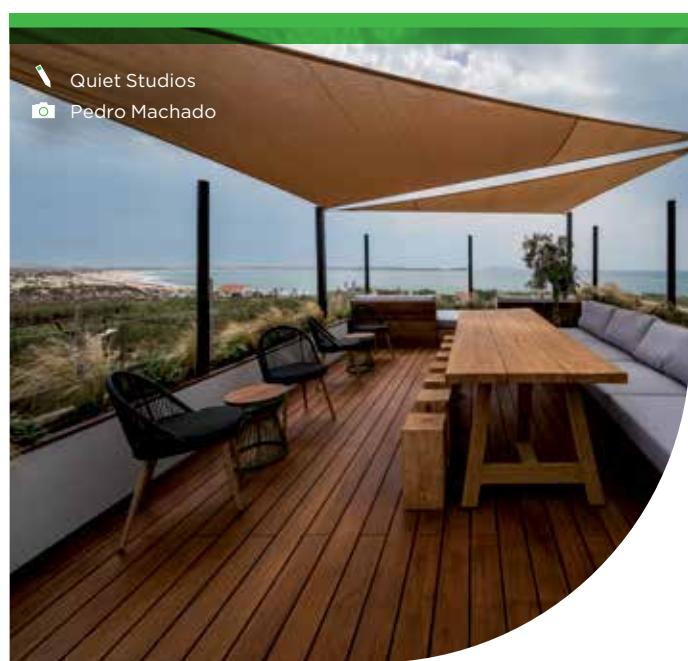


without slope

- Decking with a curved surface can be installed without a slope. Thanks to this curved surface, fast drainage from the boards is guaranteed.



Higher Roch Tower (4000 m²) Montpellier, France



Salty Hotel
(180 m²) Praia do Baleal, Portugal



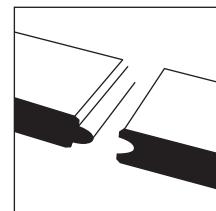
MOSO® Bamboo N-durance® Outdoor Decking

MOSO® Bamboo N-durance® Decking is a solid, Outdoor-Density® board, made from compressed bamboo strips. Bamboo N-durance® has a warm caramel colour, resulting from a steam-pressure treatment on the bamboo material. A special crushing and compression technique increases the hardness and stability and provides Bamboo N-durance® with the highest durability class possible in the appropriate EU norms. Bamboo N-durance®'s end-match system enables an unlimited number of boards to be connected creating a visually infinite length. The special symmetrical shape offers the possibility to choose between either the grooved or the flat surface and allows for quick installation with MOSO® Fasteners. When exposed to outdoor conditions, the caramel colour of MOSO® Bamboo N-durance® will naturally fade.

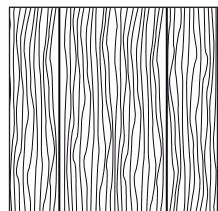
Standard Groove / Flat
(reversible board)



End-match system



Outdoor-Density®



P: Superficial preservative against surface fungi, Woca: Woca Exterior Wood Oil.
Ends of the boards are protected with Sikkens Kodrin WV 456 sealer.

Product Code	Surface	Finish	Edge groove	End-matched	Length edges	End edges	Dimensions (mm)
BO-DTC171G	Grooved/Flat	P + Woca	2 sides	Yes	R3	2 mm x 45°	1850x137x20

installation summary

- Install a suitable, fixed, stable and durable sub frame.
- MOSO® recommends the use of MOSO® Bamboo X-treme® Sub frame joists.
- Determine which side of the board will be used: the grooved or flat side.
- Fix the boards on the sub frame using fasteners (to be inserted in the edge grooves of the board) or alternatively with screws (through the surface).
- Use a 1-2% slope and ensure good ventilation of the decking. The slope is not necessary for the curved boards.
- After installation: make sure proper cleaning and maintenance is done.
- When an outdoor finish is not regularly applied the typical bamboo wood grain structure will become more visible.
- Bamboo N-durance® is available pre-oiled with Woca Exterior Wood Oil. In order to maintain the rich caramel colour it is recommended to reapply Woca Exterior Wood Oil 3 to 4 months after installation.
- Yearly maintenance with Woca Exterior Wood Oil is required to maintain the anti-surface fungi resistance.
- Yearly maintenance to retain the caramel colour and ensure the luxurious appearance.
- Store in a cool and dry place away from direct sunlight, and protected from weather influences, dirt and dust.
- For further info: please see the installation/maintenance instructions.
- Full version available on ► www.moso-bamboo.com/n-durance

technical characteristics and certifications

- Density: $\pm 1200 \text{ kg/m}^3$
- Resistance to Indentation - Brinell Hardness: $\pm 9.5 \text{ kg/mm}^2$ (average value - EN 1534)
- Reaction to fire: Class Bfl-s1 (EN 13501-1)
- Slip resistance: R10 (CEN/TS 16165 Annex B - DIN 51130)
- Modulus of Elasticity: 12090 N/mm² (mean value - EN 408)
- Bending strength: 99.6 N/mm² (characteristic value - EN 408)
- Biological durability: Class 1 according to EN 350 / CEN/TS 15083-2, simulated graveyard test / Class 1 according to EN 350 / EN 113-2 (CEN/TS 15083-1)
- Superficial preservatives and finish: comply with European biocide product regulation (BPR) and are not listed on the restrictions list of REACH Annex XVII/candidate list.
- Effectiveness against surface fungi: Class 0, Strong fungi static (EN ISO 846), treatment only superficial.
- Use Class: Class 4 (EN 335)
- Environmental Product Declaration - EPD (EN 15804) (www.moso-bamboo.com/epd)
- FSC®: Products available with FSC® certification on request.
- Contribution LEED BD+C - v4: MR 1, MR 2, MR 3 (FSC®), EQ 2, SS 7 v2009: MR 6, IEQ 4.3, IEQ 4.4
- Contribution BREEAM: MAT 1, MAT 3 (FSC®), MAT 5
- Guarantee: 25 years

Also available with FSC® certification.



The mark of
responsible forestry
FSC® C002063



breeam

MOSO® Bamboo N-durance® Outdoor Decking

accessories

Clips MOSO®

With these fasteners MOSO® Bamboo N-durance® Decking can be easily installed. When installed correctly there will be 5-6 mm gaps between the boards. The fasteners are supplied with matching stainless steel screws (square bit). For installation on aluminium sub frame joist (not provided by MOSO®), special screws are available.

Product Code	Item	Material	Colour	Dimensions fastener (mm)	Dimensions screw (mm)
CLIP-SCREW-BX08	Fastener Asymmetric with screw (20 mm)	Stainless steel A2 (AISI304)	Brown	27x22.5x10.8	4.5x30
CLIP-BX08	Fastener Asymmetric without screw (20 mm)	Stainless steel A2 (AISI304)	Brown	27x22.5x10.8	
CLIP-SCREW-BX802	Fastener Start/End Top with screw (20 mm)	Stainless steel A2 (AISI304)	Brown	29x25x11.2	4.5x30
SCREW-BX11-01	Screw for aluminium sub frame joist	Stainless steel SS410 (AISI410)	Black*		4x20



recommended number of fasteners/m² decking

137 mm wide board
~20 pcs/m²

155 mm wide board
~17 pcs/m²

Based on a centre to centre distance of 462.5 mm between the joists.

CLIP-SCREW-BX08 /
CLIP-BX08



CLIP-SCREW-BX802



SCREW-BX11-01
* Only black screw head

BO-DTC171G1



BO-DTCBN171G



BO-SB155



MOSO® Bamboo N-durance® additional products

The MOSO® Bamboo N-durance® additional products are made of the same material as the decking boards: Outdoor-Density® bamboo. The fascia board and edge profile are intended for an elegant finish of the sides of the decking. Fascia boards are installed vertically against the sides of the deck to cover the sub frame joists. Edge profiles can also be used to create stairs.

Product Code	Item	Finish	Dimensions (mm)
BO-DTC171G1	Fascia board, 1 edge groove	Woca Exterior Wood Oil	1850x137x20
BO-DTCBN171G	Edge profile, 2 edge grooves	Woca Exterior Wood Oil	1850x65x30/20

MOSO® Bamboo X-treme® Sub frame joists

The MOSO® Bamboo X-treme® Sub frame joists are made of Thermo-Density® heat-treated bamboo.

Product Code	Item	Finish	Dimensions (mm)
BO-SB155	Sub frame joist	Unfinished	2440x60x40

Cleaning & maintenance products

Under the influence of wind, rain, sun and snow the decking will weather. MOSO® recommends to maintain MOSO® Bamboo N-durance® Decking with Woca maintenance products, depending on the product installed. The silicon carbide broom and machine disk are perfectly suited to clean and smooth the decking surface of Bamboo N-durance® and to remove splinters due to the capability to sand the surface in addition to cleaning it.

Product Code	Material
DISK-01	16" Silicon carbide disk
BROOM-01	Silicon carbide broom
CLEANER-WOCA-01	Woca Exterior Wood Cleaner 2.5 ltr
OIL-WOCA-011	Woca Exterior Wood Oil Teak colour 2.5 ltr
SEALER-05	Sealer for ends of boards 250 ml
WOCA-APPLICATOR	Woca Applicator set for oil
PRIMER-WOCA-01	Woca Exterior Wood Primer 2.5 Ltr



MOSO® Bamboo N-durance® Outdoor Decking

installation instructions

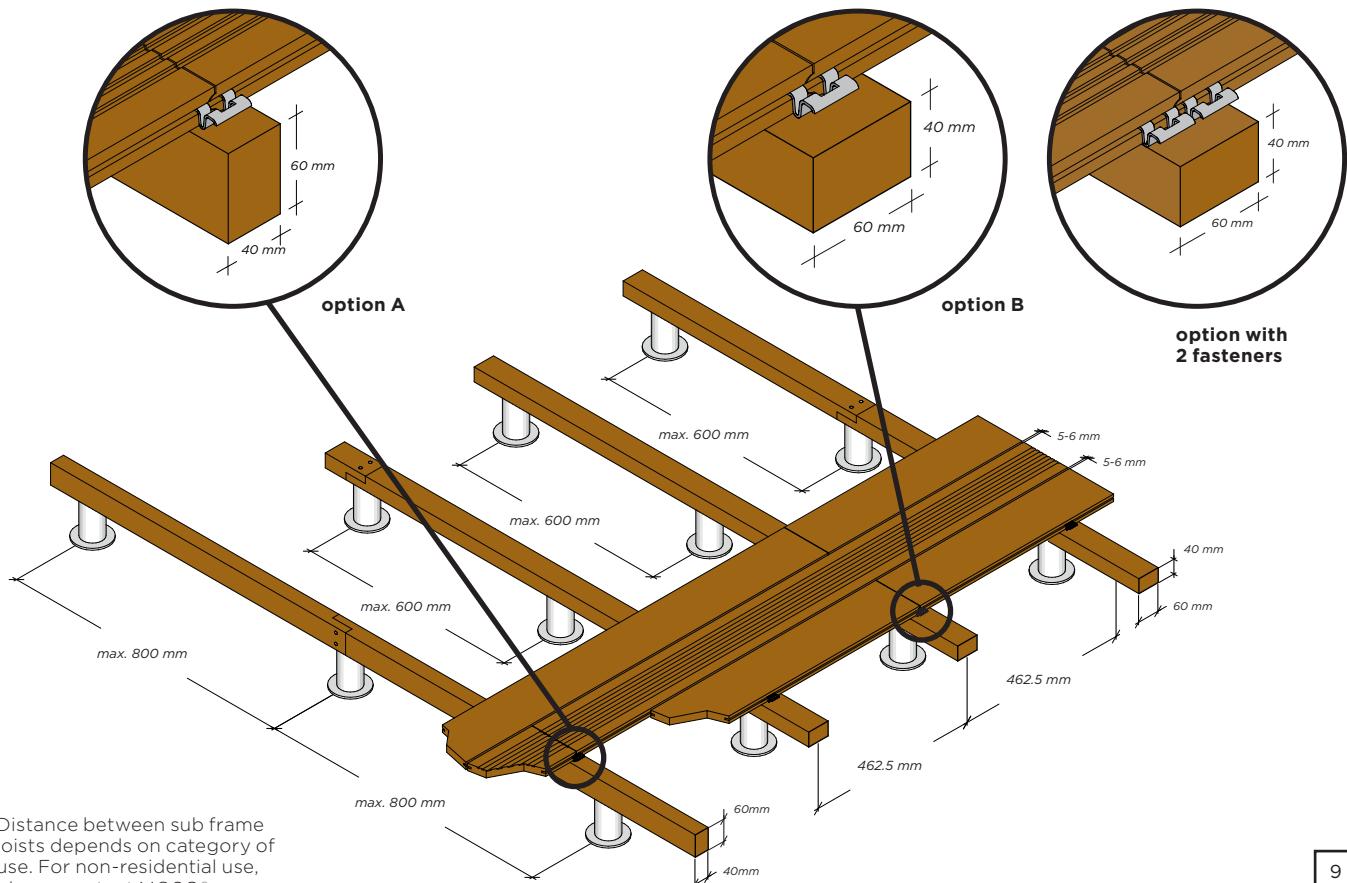
before installation

- Waterlogging under the decking must be avoided by preparing a water permeable ground structure. This can be achieved by sand layers and gravel dispersion above.
- Use cement/stone tiles 40-50 mm thick or pedestals, to support the sub frame (see drawing).
- Place a root barrier under the tiles or pedestals to prevent weeds growing under the decking.
- Install the decking boards with a slope of 1-2% to enable water to run off the surface.
- The decking with the curved surface BO-DTC191G-C can be installed without a slope. Thanks to the curved surface, fast drainage from the boards is guaranteed.
- Ensure good ventilation of the decking by keeping at least 20 mm gap from walls and objects and avoid closing the decking at the sides. The gap between the boards must be open to ensure unrestricted ventilation.
- When the surface / soil underneath the decking is not fast drying, there should be at least 100 mm distance between the decking and the surface underneath.

- Use sub frame joists with the minimum size of 40x60 mm. MOSO® recommends the use of MOSO® Bamboo X-treme® Sub frame joists, which are specifically produced for use in combination with our decking products. Alternatively, suitable joists are those with the same durability class as the decking; aluminum sub frame joists, stable hardwood joists or pine joists. When using hardwood or pine as joists, make sure the moisture content of these joists is below 12%. Avoid direct contact with the soil.
- MOSO® Sub frame joists can be installed without gaps, connecting the joists with screws and glue suited for outdoor use. Other sub frame joists should be installed according to the instructions of the supplier.
- In order to create a stable deck frame, the outsides of the frame have to be connected at regular intervals to the ground/structure below. Alternatively cross bracing can be applied.
- Install the boards on sub frame joists with 462.5 mm space between the joists (centre-to-centre) so each board is supported by 5 joists. Always install the ends of the boards exactly on the joist. Distance between sub frame joist depends on category of use. For non-residential use, please contact MOSO®.
- If a random installation pattern is preferred, make sure that the sub frame joists (centre-to-centre) are no more than 300 mm apart.
- Always install cut off boards on at least 3 sub frame joists.

please note

- The MOSO® Bamboo N-durance® Decking board is a natural product, which varies in colour, grain and appearance. Colour can quickly change from caramel to a lighter colour, depending on the maintenance schedule.
- Small cracks and splinters on the surface and on the ends of the boards can arise from the different drying characteristics of the surface and cross cut ends. The surface will also get rougher over time. This phenomenon is normal for most wood species and is minimised for this product by its unique 'Outdoor-Density®' production method. Cracks on the board ends can be further minimised by applying sealer to the ends of the boards (see 'the installation').
- Splinters and roughness can be removed by cleaning the surface of the decking with the silicon carbide broom or machine disk which MOSO® supplies. The surface will become smoother and splinters are removed.
- Dimensional changes or cupping of the boards can occur after installation. This phenomenon is normal for most wood species and is minimised for this product by its unique Outdoor-Density® production process.
- When using the flat side of the boards as surface please note that deformation under influence of climate will be more visible. Some deformation and/or cupping of the material can occur. This phenomenon is normal for outdoor exposed wood and cannot be grounds for a claim.



MOSO® Bamboo N-durance® Outdoor Decking

installation instructions

the installation

- Keep at least 5-6 mm gap between the boards (in width direction). With MOSO® Fastener installation this is automatically the case.
- Due to the stability of the boards and the end-match system, no expansion gap is needed on the ends of the boards.
- Every cut end has to be treated with board end sealer, to prevent water penetration. A sealer is available from MOSO®.
- Yearly maintenance with Woca Exterior Wood Oil is required to maintain the warm caramel colour and the anti-surface fungi resistance. For decking oiled with Woca Exterior Wood Oil, it is recommended to perform the first maintenance after 3-4 months.

installation with fasteners

- Determine the surface side of the boards (grooved or flat surface).
- Use the MOSO® Asymmetric Fasteners in the following sequence:
 - Press fastener with hooked side in the edge groove of one board.
 - Pre-drill the joist screw holes 30 mm deep. On bamboo joists: use a 3.5 mm wide drill bit 110 mm long.
 - Fully tighten the screw. Always screw vertically to the joist. Apply low torque with slow screwing speed on the screwing machine. Perform some tests for correct torque and speed adjustment before full installation.
 - Install every following board by sliding it under the waved side of the fasteners.
- Use approx. 20 fasteners per m² (137 mm) or 17 fasteners per m² (155 mm). When the tongue and groove are connected on the joist, use 1, preferably 2 fasteners, 1 for every board (see drawing options A/B).
- For bamboo or wood joists only use the included stainless steel decking screws (4.5 x 30 mm).

screw down installation

- Determine the surface side of the boards (grooved- or flat surface).
- Pre-drill the screw holes 20 mm from the side of the board. Be sure to pre drill with a large enough drill (80% of screw diameter) to avoid cracking of the decking.
- Always screw both sides (left and right in the width direction) of the board.
- Use at least A2 grade stainless steel decking screws (approx. 5 x 50 mm).

cleaning and maintenance

MOSO® Bamboo N-durance® Decking is oiled, on both sides, with Woca Exterior Wood Oil.

- Clean and maintain the decking at least once per year with Woca Exterior Wood Cleaner and silicon carbide broom or -disk. Depending on climate and use it may be necessary to perform cleaning and maintenance more than once per year.
- Remove the dirt water residue on the boards with clean water and let the surface dry.
- Prepare the surface with Woca Exterior Wood Primer. Afterwards, apply 1-2 new layers of Woca Exterior Wood Oil. When a new finish is not applied once a year, depending on the situation, the decking will change in colour. Surface (superficial) fungi may occur, but this has no effect on the material's integrity or fitness for use.
- It is advisable to keep the decking free from dust and dirt as much as possible (clean by broom regularly).

storing

Store MOSO® Bamboo N-durance® in a cool and dry place away from direct sunlight, and protected from weather influences, dirt and dust.

additional note

Whilst all due care is taken to ensure the accuracy of the installation instructions, individual circumstances (location, sub floor and installation procedures) may vary and are beyond the manufacturer's control. In case of doubt, therefore, consult the distributor. Always follow the local building code.

These instructions are subject to change. For the latest version visit www.moso-bamboo.com/n-durance

Copyright © Nothing from this text may be reproduced without the prior permission in writing from Moso International BV.

MOSO® Bamboo N-durance® Outdoor Decking

cleaning & maintenance

maintenance with Woca

The surface of decking becomes weathered under the influence of wind, rain, frost and sunshine (UV). As a result, the surface turns grey, dirty and cracks/splinters will appear. WoodCare Denmark (Woca) has developed different outdoor cleaning- and maintenance products. Woca Exterior Wood Cleaner loosens dirt and removes green growth from the surface, without damaging it. Woca Exterior Wood Oil protects the bamboo decking and bringing back the warm caramel colour.

cleaning

- Soak MOSO® Bamboo N-durance® with plenty of water. If possible use a garden hose. Do not use high-pressure cleaners.
- Mix Woca Exterior Wood Cleaner with water in the ratio 1:2 and apply it. If the decking is extremely dirty, exterior cleaner may be used undiluted. Clean the decking with a silicon carbide broom or machine disk (see accessories).
- Scrub the soaked material lengthwise following the bamboo grain until the material appears clean. If the decking has been installed flat side up, first scrub under an angle of 45 degrees before scrubbing in the length direction. When using a machine disk this is not necessary.
- Repeat the cleaning if necessary. In case some deeper stains remain after cleaning on the surface of the material, we recommend sanding (100 grit, in length grain direction).
- Clean the surface by rinsing thoroughly with clean water ensure that the surface is clean before oiling.
- Leave MOSO® Bamboo N-durance® to dry for approx. 24 hours. The material must be completely dry before oil treatment can be done.

application of oil

- Always make sure the decking is clean, dry, free of dust or dirt, and without any coating. Never work on a deck in direct sun.
- Apply in dry weather only. Avoid direct sunlight and high temperatures.
- To prepare the surface for oiling, apply Woca Exterior Wood Primer. Make sure it is fully dried before applying oil in the next step.
- Stir the oil thoroughly before use. Apply an even thin coat of oil with a brush.
- The oil is cream-coloured when it is wet.
- After a few minutes, the material has an oily appearance as the water is evaporating.
- Wipe off any excess oil with clean cotton cloths after no more than 5-10 minutes.
- Take particular care to remove excess oil from joints and grooves.
- Repeat the oiling process.
- When the material is dry, it may be polished with a polishing pad or polishing machine to ensure an extra hard-wearing surface. It takes 24 to 48 hours for the oil to harden thoroughly, depending on weather conditions and outdoor temperature. The material should not be exposed to water during this period.
- Pay attention to the ends of the joists and cut ends of the boards, which tend to absorb more water, and finish well to prevent water penetration. A sealer is available from MOSO®.

theoretical consumption

- Mix Woca Exterior Wood Cleaner with water in the ratio 1:2 and apply it. If the decking is extremely dirty, exterior cleaner may be used undiluted.
- Woca Exterior Wood Primer: 8 - 10 m² / litre.
- Woca Exterior Wood Oil: 12 - 15 m² / litre.

maintenance of flat surface

Please be aware of the fact that on the flat surface, irregularities in the surface (e.g. cracks, splinters) are more visible than on the grooved surface. With regular maintenance with Woca Exterior Wood Oil, this will be reduced.

risk of self-ignition

Due to the risk of self-ignition it is important that oil-wetted cloths are soaked in water and are disposed in a tightly closed container after use. For more details, check the instructions of the finish supplier.



Check out the maintenance and cleaning movie at:
www.moso-bamboo.com/youtube/n-durance



MOSO® Bamboo N-durance® Outdoor Decking

user information

appearance and colour

MOSO® Bamboo N-durance® 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 warm caramel colour when installed, which can change in colour several weeks after installation.

If a warm caramel colour is preferred, maintenance should be done with Woca Exterior Wood Oil or a similar waterbased finish. For further details see the installation and maintenance instructions:
www.moso-bamboo.com/n-durance

Yearly maintenance with Woca Exterior Wood Primer and Woca Exterior Wood Oil will be required to maintain the warm caramel colour and the anti-surface fungi resistance. For decking oiled with Woca Exterior Wood Oil it is recommended to perform the first maintenance after 3-4 months.

MOSO® Bamboo N-durance® shows similarity to other hardwoods in grain and structure. The characteristic bamboo nodes however can still be recognised and give the product a special and lively look.

swimming pool

If MOSO® Bamboo N-durance® Outdoor Decking is to be used around swimming pool areas, the following has to be taken into account: MOSO® Bamboo N-durance® is a natural (wood like) product. As with any wooden product used outdoors, there is always a risk of formation of splinters, however splinters from MOSO® Bamboo N-durance® are normally smaller than (tropical) hard wood splinters. A regular application of a finish (more frequently necessary around swimming pools) is required to reduce the formation of splinters. Furthermore, regular maintenance with the silicon carbide broom or disk is required to effectively remove splinters and smoothen the surface. The boards must be installed in such a way that the surface water cannot flow directly into the pool. Also bear in mind that treated swimming pool water contains salt and chlorine which can cause the boards around the pool to "weather" and become bleached faster than the boards in areas not exposed to the swimming pool water.

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.

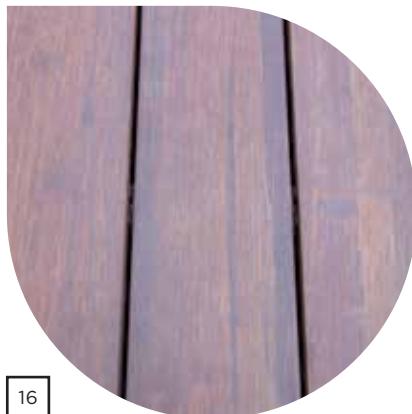
The surface side of the boards will become rougher over time and can form (small) splinters as a result of continuous water absorption and desorption due to dry and wet weather periods. Dimensional change or cupping of the boards can occur after installation. These phenomena are normal for most hardwood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

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 N-durance® material, however controlled water drainage and prevention of splash water is required to prevent any discolouration of surrounding or underlying building components.

maintenance of flat surface

When using the flat side of the boards as top surface please note that deformation under influence of climate may be more visible. Some deformation and/or cupping of the material can occur. This phenomenon is normal for outdoor exposed wood and cannot be grounds for a claim.

dry condition



wet condition



MOSO® Bamboo N-durance® Outdoor Beams

user information

appearance and colour

MOSO® Bamboo N-durance® is a natural product, which can vary in colour, grain and appearance. Colour will change over time depending on the maintenance schedule. The beams have a warm caramel colour when installed, which can change in colour several weeks after installation.

If a warm caramel colour is preferred, maintenance should be done with Sikkens Cetol WF 771 or a similar waterbased finish. Periodic maintenance with Sikkens Cetol WP 567 BPD and Sikkens Cetol WF 771 is required to maintain the warm caramel colour and the anti-surface fungi resistance. For further details see the installation and maintenance instructions: www.moso-bamboo.com/n-durance

MOSO® Bamboo N-durance® shows similarity to other hardwoods in grain and structure. The characteristic bamboo nodes however can still be recognised and give the product a special and lively look.

normal phenomena

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

The surface side of the beams 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 beams can occur after installation. These phenomena are normal for most hardwood species and MOSO® Bamboo N-durance® and cannot be grounds for a claim.

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 N-durance® material, however controlled water drainage and prevention of splash water is required to prevent any discoloration of surrounding or underlying building components.

swimming pool

If MOSO® Bamboo N-durance® Outdoor Beams are to be used around swimming pool areas, the following has to be taken into account: MOSO® Bamboo N-durance® is a natural (wood like) product. As with any wooden product used outdoors, there is always a risk of formation of splinters, however splinters from MOSO® Bamboo N-durance® are normally smaller than (tropical) hard wood splinters. A regular application of a finish (more frequently necessary around swimming pools) is required to reduce the formation of splinters. Furthermore, regular maintenance with the silicon carbide broom or -disk is required to effectively remove splinters and smoothen the surface. The beams must be installed in such a way that the surface water cannot flow directly into the pool. Also bear in mind that treated swimming pool water contains salt and chlorine which can cause the beams around the pool to "weather" and become bleached faster than the boards in areas not exposed to the swimming pool water.

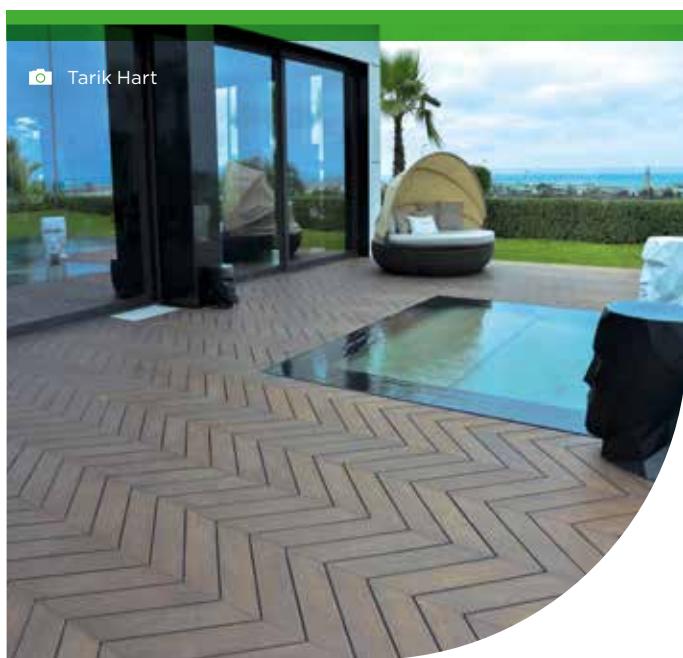






Tim Baynham -
Wildlife Safety Solutions

Imagine Africa - Luxury Tented Camp (900 m²) South Africa



Private Residence Casablanca
Casablanca, Morocco

Bridge Pont d'Issy Orange Head Office
(1200 m²) Issy-les-Moulineaux, France



Viguier
Daniel Osso Photographe

MOSO® Bamboo X-treme® Outdoor Decking

MOSO® Bamboo X-treme® Decking is a solid, Thermo-Density® board, made from compressed bamboo strips. A special, unique heat-treatment process at 200°C provides MOSO® Bamboo X-treme® with the highest durability class possible in the appropriate EU norms (see technical characteristics below) and the compression increases the hardness and stability. A unique feature of MOSO® Bamboo X-treme® is the end-match system: this can only be done with very stable materials and enables the connection of an unlimited number of boards lengthways. The special symmetrical shape of the sides allows the possibility to choose either the grooved or the flat surface, and allows for quick installation with MOSO® Fasteners. Like any tropical hardwood species, when exposed to outdoor conditions, MOSO® Bamboo X-treme® will turn grey over time creating a very natural look.



*) Ends of the boards are protected with Sikkens Kodrin WV 456 sealer.

Sikkens Cetol*	Unfinished	Surface	Edge groove	End-matched	Length edges	End edges	Dimensions (mm)
BO-DTHT171G-01	BO-DTHT170G	Standard Groove/Flat	Yes	Yes	R3	2 mm x 45°	1850x137x20
BO-DTHT171G1-01	BO-DTHT170G1	Standard Groove/Flat	One side	Yes	R3	2 mm x 45°	1850x137x20
BO-DTHT171G-01-AS2		2 Non-slip lines	Yes	Yes	R3	2 mm x 45°	1850x137x20
BO-DTHT181G-01	BO-DTHT180G	Standard Groove/Flat	Yes	Yes	R3	2 mm x 45°	1850x137x18
BO-DTHT181-01	BO-DTHT180G	Standard Groove/Flat	No - endprofile	Yes	R3	2 mm x 45°	1850x137x18
BO-DTHT371-01	BO-DTHT370	Standard Groove/Flat	No	Yes	R3	2 mm x 45°	1850x137x30
BO-DTHT191G-01	BO-DTHT190G	Standard Groove/Flat	Yes	Yes	R3	2 mm x 45°	1850x155x20
BO-DTHT191G-C-01		Curved	Yes	Yes	R3	2 mm x 45°	1850x155x20
BO-DTHT191GV-01	BO-DTHT190GV	V-Grooved/Flat	Yes	Yes	R3	2 mm x 45°	1850x155x20
BO-DTHT191GV-R-01		V-Grooved/Brushed	Yes	Yes	R3	2 mm x 45°	1850x155x20
BO-DTHT211G-01	BO-DTHT210G	Standard Groove/Flat	Yes	Yes	R3	2 mm x 45°	1850x178x20
BO-DTHT231GV-R-01		V-Groove/Brushed	Yes	Yes	R3	2 mm x 45°	1850x208x20
BO-DTHT163G-CHV-01		Chevron Flat	Yes	No	R3	2 mm x 45°	566(703)x137x30/20

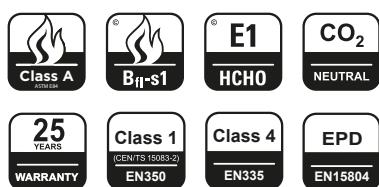
Installation summary

- Install suitable, fixed, stable and durable sub frame joists.
- MOSO® advises the use of MOSO® Bamboo X-treme® Sub frame joists.
- Determine which side of the board will be used: the grooved or flat side.
- Fix the boards on the sub frame using fasteners (to be inserted in the grooves of the board) or alternatively with screws (through the surface).
- Use a 1-2% slope and ensure good ventilation. The slope is not necessary for the curved boards.
- After installation: make sure proper cleaning and maintenance is done, according to the chosen finish.
- When not applying Sikkens Cetol WF 771 finish regularly, the deck will acquire a grey colour tone and the typical bamboo wood grain structure will become less visible.
- Bamboo X-treme® is available finished or unfinished. Treatment after installation with waterbased Sikkens Cetol WF 771 finish is recommended for all unfinished versions. For decking finished with Sikkens Cetol WF 771 the first maintenance can be performed after one year.
- Store in a cool and dry place away from direct sunlight, and protected from weather influences, dirt and dust.
- Full version available at ► www.moso-bamboo.com/x-treme decking
- Installation instructions for chevron decking board available at ► www.moso-bamboo.com/x-treme decking-chevron

technical characteristics and certifications

- Density: $\pm 1150 \text{ kg/m}^3$
- Dimensional stability: length: $\pm 0.1\%$; width $\pm 0.9\%$ (24 hours in water 20°C)
- Resistance to Indentation - Brinell Hardness: $\pm 9.5 \text{ kg/mm}^2$ (average value - EN 1534)
- Reaction to fire: Class Bfl-s1 (EN 13501-1)
- Flame spread index: Class A (ASTM E84)
- Slip resistance - Pendulum friction test: PTV 55 (Standard Groove/Flat, Dry), PTV 29 (Standard Groove/Flat, Wet), PTV 91 (Brushed, Dry), PTV 42 (Brushed, Wet) (CEN/TS 16165 Annex C - CEN/TS 15676)
- Slip resistance - Shod ramp test: R 10 (Standard Groove/Flat), R 11 (Brushed), R 13 (Non-slip) (CEN/TS 16165 Annex B - DIN 51130)
- Slip resistance - Barefoot ramp test: Class C (Standard Groove/Flat) (CEN/TS 16165 Annex A - DIN 51097)
- Thermal emittance: 0.81 (ASTM C1371) ¹⁾
- Solar Reflectance (SR): 0.32 (ASTM C1549) ¹⁾
- Solar Reflectance Index (SRI): Low 27, Medium 30, High 33 (ASTM E1980) ¹⁾
- 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 O (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)
- FSC®: Products available with FSC® certification on request.
- Contribution LEED BD+C - v4: MR 1, MR 2, MR 3 (FSC®), EQ 2, SS 7 v2009: MR 6, MR 7 (FSC®), IEQ 4.3, IEQ 4.4
- Contribution BREEAM: MAT 1, MAT 3 (FSC®), MAT 5 (HD)
- Guarantee: 25 years

¹⁾ Tested on 3 years weathered MOSO® Bamboo X-treme®.



Also available with FSC® certification.



The mark of
responsible forestry
FSC® C002063



breeam

MOSO® Bamboo X-treme® Outdoor Decking & Cladding accessories

MOSO® Fasteners

With these fasteners MOSO® Bamboo X-treme® Decking and Cladding can be easily installed. When installed correctly, there will be 5-6 mm gaps between the boards. The fasteners are supplied with matching stainless steel screws (square bit). For installation on aluminium sub frame joist (not provided by MOSO®), special screws are available.

Product Code	Item	Material	Colour	Dimensions fastener (mm)	Dimensions screw (mm)
CLIP-SCREW-BX08	Fastener Asymmetric with screw (20 mm)	Stainless steel A2 (AISI304)	Brown	27x22.5x10.8	4.5x30
CLIP-BX08	Fastener Asymmetric without screw (20 mm)	Stainless steel A2 (AISI304)	Brown	27x22.5x10.8	
CLIP-SCREW-BX802	Fastener Start/End Top with screw (20 mm)	Stainless steel A2 (AISI304)	Brown	29x25x11.2	4.5x30
CLIP-SCREW-BX09	Fastener Asymmetric with screw (18 mm)	Stainless steel A2 (AISI304)	Brown	27x22.5x9.8	4.5x30
CLIP-BX09	Fastener Asymmetric without screw (18 mm)	Stainless steel A2 (AISI304)	Brown	27x22.5x10.8	
SCREW-BX11-01	Screw for aluminium sub frame joist	Stainless steel S410 (AISI410)	Black*		4x20
CHEVRON-TOOL01	Chevron installation tool	Wood			



recommended number of fasteners/m ²	
decking*	cladding**
137 mm board width	137 mm board width
~20 pcs/m ²	~14 pcs/m ²
155 mm board width	75 mm board width
~17 pcs/m ²	~26 pcs/m ²
178 mm board width	
~14 pcs/m ²	
208 mm board width	
~13 pcs/m ²	

*) Based on distance of 462.5 mm between the sub frame joist centres.

**) Based on distance of 600 mm between the sub frame joist centres.

CLIP-SCREW-BX08 / BX09
CLIP-BX08 / BX09



CLIP-SCREW-BX802 SCREW-BX11-01
* Only black screw head



BO-SB155



BO-DTHT171G1-01/ BO-DTHT170G1



BO-DTHTBN171G-01



BO-DTHTBN500



MOSO® Bamboo X-treme® additional products

The MOSO® Bamboo X-treme® additional products are made of the same material as the decking boards: Thermo-Density® heat-treated bamboo. MOSO® recommends the use of Bamboo X-treme® Sub frame joists, which are specifically produced for use in combination with MOSO® Decking. The MOSO® Bamboo X-treme® Fascia board and Edge profile are intended for an elegant finish of the sides of the decking. Fascia boards are installed vertically against the sides of the deck to cover the sub frame joists. Edge profiles can also be used to create stairs.

Product Code	Item	Finish	Dimensions (mm)
BO-SB155	Sub frame joist	Unfinished	2440x60x40
BO-DTHT170G1	Fascia board, 1 edge groove	Unfinished	1850x137x20
BO-DTHT171G1-01	Fascia board, 1 edge groove	Sikkens	1850x137x20
BO-DTHT181-01	Fascia board	Sikkens	1850x137x18
BO-DTHTBN171G-01	Edge profile, 2 edge grooves	Sikkens	1850x65x30/20

Maintenance & cleaning products

Under the influence of wind, rain, sun and snow the decking will weather. MOSO® recommends impregnating and maintaining the finished decking with Sikkens maintenance materials. It is recommended to finish the unfinished decking with Sikkens right after installation. The silicon carbide broom and machine disk are perfectly suited to clean and smooth the decking surface of Bamboo X-treme® and to remove splinters due to the capability to sand the surface in addition to cleaning it.

Product Code	Material
SEALER-05	Sikkens Kodrin WV 456 - Sealer for ends of boards 250 ml
DISK-01	16" Silicon carbide disk
BROOM-01	Silicon carbide broom
SATURATOR-SIK01	Sikkens Cetol WF 771 Ipe colour 10 ltr
SATURATOR-SIK02	Sikkens Cetol WF 771 Ipe colour 2.5 ltr

MOSO® Bamboo X-treme® Outdoor Decking

installation instructions

before installation

- Make sure that the installation of the decking complies with local building regulations and guidelines.
- Waterlogging under the decking must be avoided by preparing a water permeable ground structure. This can be achieved by sand layers and gravel dispersion above.
- Use cement/stone tiles 40-50 mm thick or pedestals, to support the sub frame (see drawing).
- Place a root barrier under the tiles and pedestals to prevent weeds growing under the decking.
- We recommend installing the decking boards with a slope of 1-2% to enable water to run off the surface. Alternatively, the decking can be installed without a slope, but due to the fact that water stays on the surface longer, it is possible more superficial cracks will develop. If the installation is done without a slope, more cleaning will be required.
- The decking with the curved surface BO-DTHT191G-C-01 can be installed without a slope. Thanks to the curved surface, fast drainage from the boards is guaranteed.
- Ensure good ventilation of the decking by keeping at least 20 mm gap from walls and objects and avoid closing the decking at the sides. The gap between the boards must be open to ensure unrestricted ventilation.
- When the surface / soil underneath the decking is not fast drying, there should be at least 100 mm distance between the decking and the surface underneath.
- Use sub frame joists with the minimum size of 40x60 mm. MOSO® recommends the use of MOSO® Bamboo X-treme® Sub frame joists, which are specifically produced for use in combination with our decking products. Alternatively, suitable joists are those with the same durability class as the decking; aluminum sub frame joists, stable hardwood joists or pine joists. When using hardwood or pine as joists,

make sure the moisture content of these joists is below 12%. Avoid direct contact with the soil.

- MOSO® sub frame joists can be installed without gaps, connecting the joists with screws and glue suited for outdoor use. Other sub frame joists should be installed according to the instructions of the supplier.
- In order to create a stable deck frame, the outsides of the frame have to be connected at regular intervals to the ground / structure below. Alternatively cross bracing can be applied.
- Install the boards on sub frame joists with 462.5 mm space between the joists (centre-to-centre) so each board is supported by 5 joists. Always install the ends of the boards exactly on the joist. Distance between sub frame joist depends on category of use. For non-residential use, please contact MOSO®. Other span possibilities see 'Span recommendation' table below.
- If a random installation pattern is preferred, make sure that the sub frame joists (centre-to-centre) are no more than 300 mm apart.
- Always install cut boards on at least 3 sub frame joists.

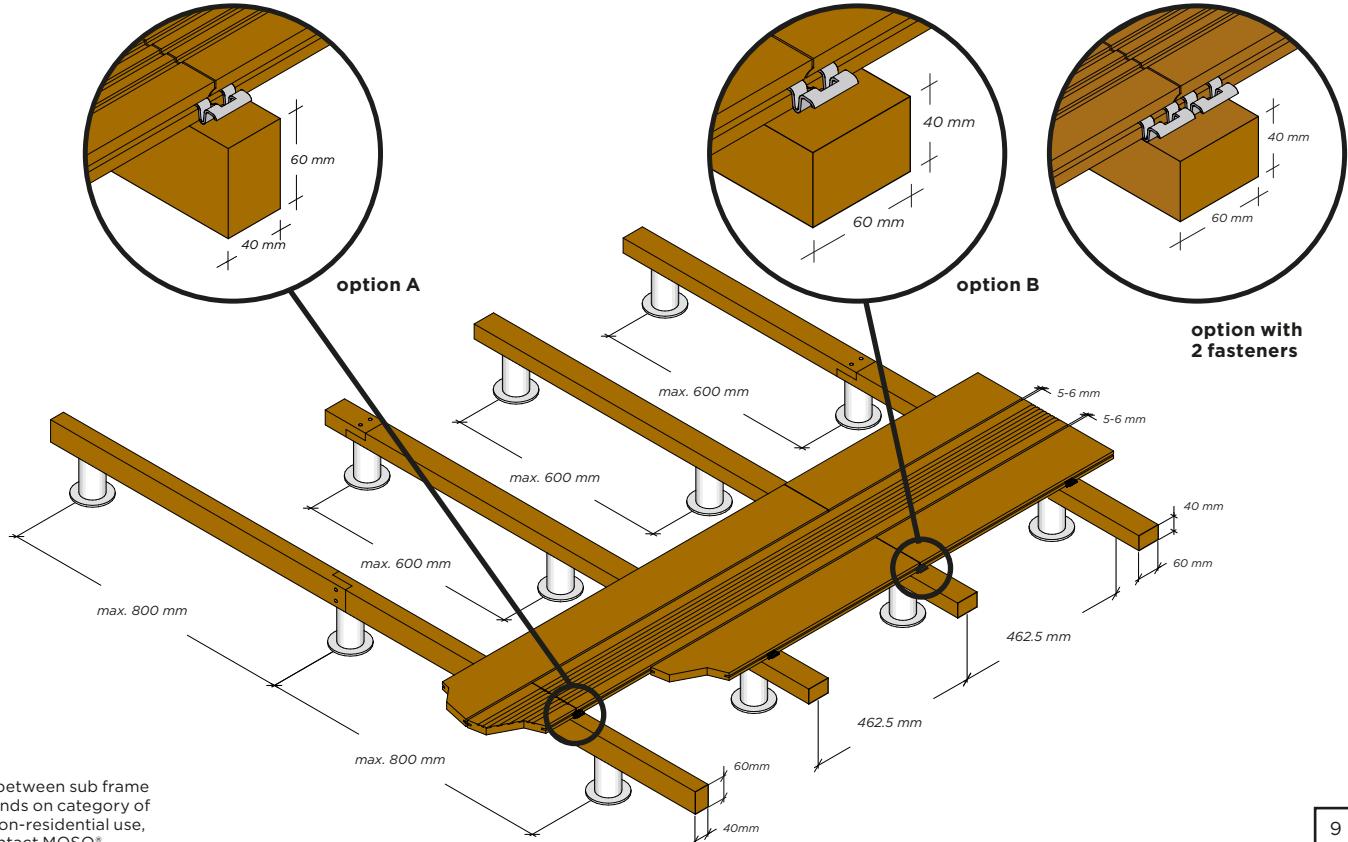
please note

- The MOSO® Bamboo X-treme® Outdoor Decking Board is a natural product, some variation in colour, grain and appearance is normal. Colour can change fast from dark brown to brown or grey, depending on the climatic conditions and maintenance schedule. Occasionally, some bleeding can appear.
- Small cracks and splinters on the surface and on the end of the boards can arise from the different drying characteristics of the surface and cross cut ends. The surface will also get rougher over time. This phenomenon is normal for most wood species and is minimised for this product by its unique 'Thermo-Density®' production method. Cracks on the board ends can be further minimised by applying sealer to the ends of the boards (see 'the installation').
- Splinters and roughness can be removed by cleaning the surface of the decking with the silicon carbide broom or machine disk which MOSO® supplies. The surface will become smoother and splinters are removed.
- Dimensional changes or cupping of the boards can occur after installation. This phenomenon is normal for most wood species and is minimized for this product by its unique Thermo-Density® production process.
- When using the flat side of the boards as top surface please note that deformation under influence of climate may be more visible. Some deformation and/or cupping of the material can occur. This phenomenon is normal for outdoor exposed wood and cannot be grounds for a claim.

Span recommendation

MOSO® Bamboo X-treme® Decking, with a thickness of 20 mm, can be installed with different span.

Center-to-center span sub frame joists	End-match joint lies	Deflection between joists
462.5 mm	On top of joist	Hardly noticeable
462.5 mm	Between joists, max. 15 cm from one joist	Noticeable
300 mm	Between joists	Hardly noticeable



MOSO® Bamboo X-treme® Outdoor Decking

installation instructions

the installation

- Keep at least 5-6 mm gap between the boards (in width direction). With MOSO® Fastener installation this is automatically the case.
- Due to the stability of the boards and the end-match system, no expansion gap is needed on the ends of the boards.
- Every cut end has to be treated with board end sealer, to prevent water penetration. A sealer is available from MOSO®.
- We advise to oil the decking shortly after installation but no later than after the first winter. The best time is 3-4 months after installation when the surface is more open than immediately after installation.

installation with MOSO® Asymmetric Fasteners

- Determine the surface side of the boards (grooved or flat surface).
- Press fastener with hooked side in the edge groove of one board.
- Pre-drill the joist screw holes 30 mm deep. On bamboo joists: use a 3.5 mm wide drill bit 110 mm long.
- Fully tighten the screw. Always screw vertically to the joist. Apply low torque with slow screwing speed on the screwing machine. Perform some tests for correct torque and speed adjustment before full installation.
- Install every following board by sliding it under the waved side of the fasteners.
- Use approx. 20/17/14/13 fasteners per m², this depends on the board width. When the tongue and groove are connected on the joist, use 1 fastener (preferably 2 fasteners) to tighten both boards (see drawing page 9 option A / B).
- For bamboo or wood joists only use the included stainless steel decking screws (4.5 x 30 mm).
- Please watch the installation video www.moso-bamboo.com/youtube/x-treme

screw down installation

- Determine the surface side of the boards (grooved or flat surface).
- Pre-drill the screw holes 20 mm from the side of the board. Be sure to pre drill with a large enough drill (80% of screw diameter) to avoid cracking of the decking.
- Always screw both sides (left and right in the width direction) of the board.
- Use at least A2 grade stainless steel screws: approx. 5 x 50 mm for 20 mm thickness decking board. Approx. 5 x 70 mm for 30 mm thickness decking board.

chevron installation

It is also possible to install the decking boards in a chevron pattern. Please follow the installation instructions at:

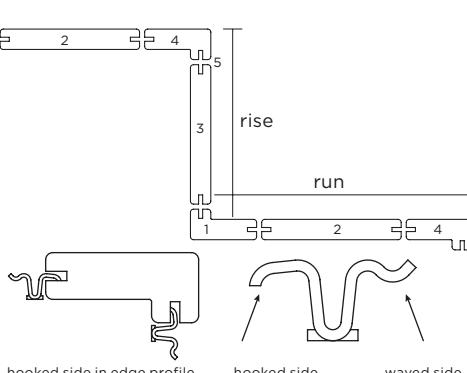
www.moso-bamboo.com decking-chevron

edge profile installation

- When finishing the edge of a deck with the MOSO® Bamboo X-treme® Edge profile, it is important to place the hooked side of the MOSO® Fastener in the edge profile grooves (see drawing below).
- The edge profile can also be used for stairs. Standard Bamboo X-treme® stair dimensions are available in the table below. For other dimensions, boards have to be cut to size and either installed screwed down through the board or with fasteners in new edge grooves made on site.
- In case of stair application: Install decking and edge profiles on the decking steps substructure in the following sequence (the numbers refer to the drawing below):
 1. Attach the edge profile(s) in the inner corner of the steps to the sub structure with MOSO® Asymmetric Fasteners. Place fasteners with a maximum centre-to-centre distance of 462,5 millimeters. Ensure the hooked side of the MOSO® Fastener (see drawing below) is placed in the edge grooves of the edge profile. Fully tighten the screws.
 2. Slide the horizontal decking board(s) in place. Do not fix the other side yet (so no fastener placed).
 3. Slide the vertical decking board(s) in place and attach the top side to the substructure with fasteners. Ensure the waved side of the fastener is placed in the edge groove of the board. Do not fully tighten the screws yet.
 4. Slide the outer corner edge profile(s) in place. Slide MOSO® Asymmetric Fasteners between the decking board(s) (nr. 2 & 3 in the drawing below) and the edge profile(s), ensuring correct orientation of the fasteners. Attach to the sub structure. Fully tighten the screws.
 5. Fully tighten the screws left unsecured in step 3.

run/rise dimensions

vertical orientation	horizontal orientation
run (board 2)	run (board 2)
137 mm = 189 mm	137 mm = 259 mm
155 mm = 207 mm	155 mm = 277 mm
178 mm = 230 mm	178 mm = 300 mm
rise (board 3)	rise (board 3)
137 mm = 259 mm	137 mm = 189 mm
155 mm = 277 mm	155 mm = 207 mm
178 mm = 300 mm	178 mm = 230 mm



cleaning and maintenance

Sikkens Cetol finished version

- The MOSO® Bamboo X-treme® Decking is finished with Sikkens Cetol WF 771 finish (waterbased - Ipe color) on both sides.
- It is advisable to keep the deck clear of dust and dirt as much as possible (sweep regularly).
- For annual maintenance: use of Woca exterior cleaner is recommended. If the deck is not grey, but just lightly weathered, it is sufficient to just clean with cleaner and brush. After drying, again apply Sikkens Cetol WF 771 finish according MOSO® maintenance instructions. Follow the instructions at: www.moso-bamboo.com/youtube/x-treme
- Apply one layer new Sikkens Cetol WF 771 finish. This maintenance should be undertaken 1-2 times a year to prevent the bamboo becoming grey and losing its characteristic bamboo grain. Follow instructions at: www.moso-bamboo.com/youtube/x-treme
- After application of the Sikkens Cetol WF 771 finish allow the deck to dry sufficiently before using it again.

unfinished version

- You can leave the decking without any maintenance, but take into consideration that without maintenance and oiling the deck will develop a rougher, fissured surface that will lighten quicker and become grey (similar to most timber).
- Application of a waterbased penetrating finish (pigmented) immediately after installation is recommended. The finish Sikkens Cetol WF 771 (Ipe colour) is recommended.
- Clean the decking with clean water, cleaner and a stiff brush. Once dry, apply the Sikkens Cetol WF 771 finish according to MOSO® maintenance instructions. Regular cleaning with a stiff brush is recommended.
- For annual maintenance: Use of Woca Exterior Cleaner is recommended. If the deck is not grey, but just lightly weathered, it is sufficient to just clean with soap and brush. After drying, again apply Sikkens Cetol WF 771 finish according MOSO® maintenance instructions.

storing

Store in a cool and dry place away from direct sunlight, and protected from weather influences, dirt and dust.

additional note

Whilst all due care is taken to ensure the accuracy of the installation instructions, individual circumstances (location, sub floor and installation procedures) may vary and are beyond the manufacturer's control. In case of doubt, therefore, consult the distributor. Always follow the local building code.

These instructions are subject to change. For the latest version visit: www.moso-bamboo.com/x-treme decking

Copyright © Nothing from this text may be reproduced without the prior permission in writing from Moso International BV.

MOSO® Bamboo X-treme® Outdoor Decking

maintenance & cleaning

maintenance Sikkens

Cetol WF 771

The maintenance and cleaning of the MOSO® Bamboo X-treme® Decking is similar to other tropical wood, with the difference that water-based finish oils provide greater protection than traditional oils. Sikkens Cetol WF 771 water-based finish is recommended for optimal protection.

maintenance of flat surface

Please be aware of the fact that on the flat surface, irregularities in the surface (e.g. cracks, splinters) may be more visible than on the grooved surface. With regular maintenance, using a waterbased decking finish, this will be reduced.



cleaning

- Soak MOSO® Bamboo X-treme® with plenty of water and leave it for 10 min. If possible use a garden hose. Do not use high-pressure cleaners.
- Mix Woca Exterior Wood Cleaner with water in the ratio 1:2 and apply it. If the decking is extremely dirty, exterior cleaner may be used undiluted. Clean the decking with a silicon carbide broom or machine disk (see accessories). Scrub the soaked material lengthwise following the bamboo grain until the material appears clean. If the decking has been installed flat side up, first scrub at an angle of 45 degrees before scrubbing in the length direction. When using a machine disk this is not necessary. Repeat the cleaning if necessary. Clean the surface carefully with water.
- Leave MOSO® Bamboo X-treme® to dry for approx. 24 hours. The material must be completely dry before oil treatment can be done.



application of finish

- Always make sure the decking is clean, dry, free of dust or dirt, and without any coating. Never work on a deck in direct sun.
- In areas where Sikkens Cetol finish remains after cleaning, we recommend sanding (100 grit). If the area to be sanded is too large, use a polishing machine with a silicon carbide disk or a 100 grit sanding paper disk.
- Stir the Sikkens Cetol before and during the application to avoid colour variation.
- Apply a thin layer of finish with a pad, a brush, or with an air gun (35 to 65 bar) on the working surface (decking with non slip grit only with a brush).
- Important: remove any excess product before it dries, to avoid any dripping or glossy areas. The finish must penetrate the material and not remain on the surface, so that it dries leaving a matt look.
- Pay attention to the ends of the joists and cut ends of the boards, which tend to absorb more water, and finish well to minimise water ingress. A sealer is available from MOSO.

theoretical consumption

- Mix Woca Exterior Wood Cleaner with water in the ratio 1:2 and apply it. If the decking is extremely dirty, exterior cleaner may be used undiluted.
- Sikkens Cetol WF 771 lpe - for the first treatment: 10 - 12 m² / litre (for 1 coat of finish).
- Sikkens Cetol WF 771 - for periodic maintenance: 14 - 15 m² / litre (for 1 coat of finish).

Gradual greying of MOSO® Bamboo X-treme® over time:

new,
non-weathered decking



after 18 months
of weathering

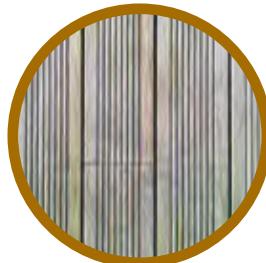


after 3 months
of weathering



Surface of MOSO® Bamboo X-treme® with different maintenance and cleaning scenarios:

weathered,
dirty decking



re-oiled decking



weathered,
cleaned decking



Check out the maintenance and cleaning movie at:
www.moso-bamboo.com/youtube/x-treme

MOSO® Bamboo X-treme®

test results



The excellent performance of MOSO® Bamboo X-treme® has been extensively tested by acknowledged research institutes. Find a summary of the most important test results below. Full reports are available upon request. **Only 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 of 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
(EN 807) /
EN 350

class 1



Durability of heat 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

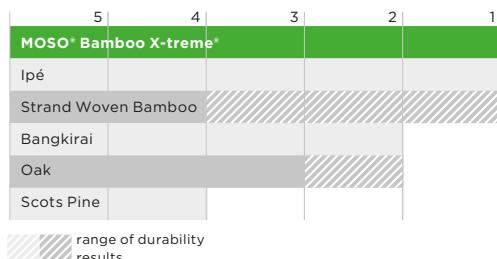
class 0

harder and more durable than almost any other hardwood

durability class

class 1

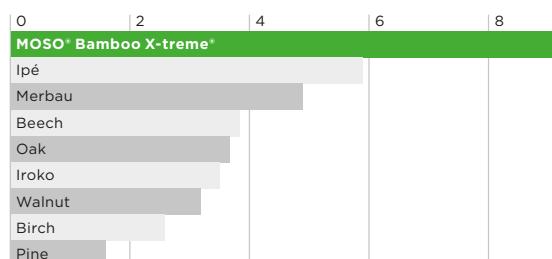
(EN 350 (CEN/TS 15083-2 / CEN/TS 15083-1)



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.

4. Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with clause 12 of EN 13501-1:2007+A1:2009.

4.2 Classification

The product, BAMBOO X-TREME™ DECKING, in relation to its reaction to fire behaviour is classified:

B_n

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_n - s1

Efectis

Efectis Nederland BV
2013Efectis-NL022 (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

* 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/ica
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.

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

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

experts in sustainability
nibe

Author:
NIBE experts in sustainability
Dr. ir. Pablo van der Ligt, Sustainability Manager Moso International B.V.
N. Nicholson, Sustainability Specialist Moso International B.V.

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

decking

class Bfl-s1

cladding, fencing, beams

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

test results of MOSO® Bamboo N-durance®

The excellent performance of MOSO® Bamboo N-durance® has been extensively tested by acknowledged research institutes. Find a summary of the most important test results below. Full reports are available upon request. **Only MOSO® can ensure you have the original, unique Bamboo N-durance® product.** Other products that copy the original do not offer the same quality 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 MOSO® Bamboo N-durance® products!

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 N-durance® not tested in salt water.

durability

EN 350 / CEN/TS 15083-2
EN 350 / EN 113-2
(CEN/TS 15083-1)

class 1

use/risk class

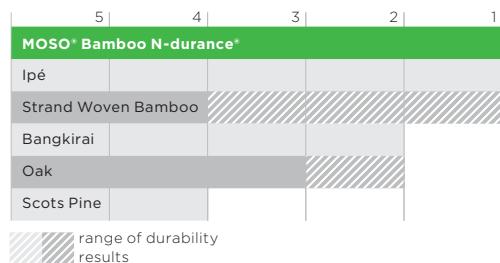
EN 335

class 4

durability class

class 1

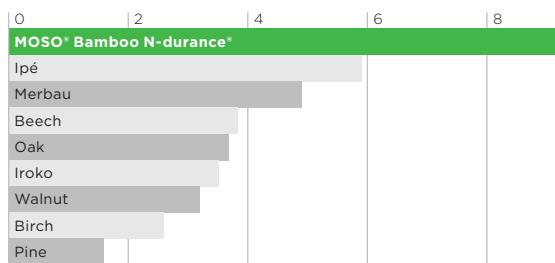
EN 350 (CEN/TS 15083-2) and EN 350 / EN 113-2 (CEN/TS 15083-1)



average brinell hardness

± 9.5 kg/mm²

(EN 1534)



5 Test results

Summarized results of dry mass losses and the assigned durability classes with each fungus are shown in table 2. Negative mass losses (mass increase) were considered to be zero when calculating mean and median values. Single values can be provided by EPH on request.

Table 2: Results of the durability test of "MOSO Bamboo N-durance (outdoor)"

Test fungus	mean dry mass loss (n = 20) [%]	median dry mass loss (n = 20) [%]	percentage of specimens in DC classes [%]					durability classification (see table 3)	
			DC 1	DC 2	DC 3	DC 4	DC 5		
<i>C. puteana</i>	1,8 ± 1,1	2,2	100	0	0	0	0	1	
<i>R. placenta</i>	1,5 ± 0,9	1,3	100	0	0	0	0	1	
<i>G. trabeum</i>	1,6 ± 1,0	1,5	100	0	0	0	0	1	
<i>T. versicolor</i>	1,6 ± 0,8	1,5	100	0	0	0	0	1	
<i>P. ostreatus</i>	3,7 ± 1,0	3,7	95	5	0	0	0	1	
<i>D. expansa</i>	0,9 ± 1,0	0,5	100	0	0	0	0	1	
Final DC classification: 1 (very durable)									

5 Results

Each one specimen was grown very slightly at the edge area by fungi; all of the other specimens were free from growth (table 2, figures 4 and 5). The agar surrounding the specimens was grown heavily at eight of ten test vessels.

Table 2: Rating¹ of the growth on the specimen surface / agar surface

	sp. 1	sp. 2	sp. 3	sp. 4	sp. 5
Fungus mix I (EN 846)	2/5	0/5	0/5	0/5	0/5
Fungus mix II (discolouring moulds)	0/0	0/0	2/3	0/5	0/5

¹⁾ Rating scale

- 0 no growth detectable at microscopic inspection
- 1a growth detectable by microscopic inspection on max. 25 % of the test surface
- 1b growth detectable by microscopic inspection on max. 50 % of the test surface
- 1c growth detectable by microscopic inspection on more than 50 % of the test surface
- 2 growth visible to the naked eye on max. 25 % of the test surface
- 3 growth visible to the naked eye on max. 50 % of the test surface
- 4 growth visible to the naked eye on more than 50 % of the test surface
- 5 heavy growth on the whole test surface

durability

EN 350 / CEN/TS 15083-2

EN 350 / EN 113-2

(CEN/TS 15083-1)

class 1

resistance against surface fungi

EN ISO 846:2019

resistant to wooddiscolouring fungi

class 0

CLASSIFICATION AND FIELD OF APPLICATION

4.1 REFERENCE OF CLASSIFICATION

This classification has been carried out in accordance with clause 12 of EN 13501-1:2018.

4.2 CLASSIFICATION

The product, **MOSO® Bamboo N-durance**, in relation to its reaction to fire behaviour is classified:

B₁

The additional classification in relation to smoke production is:

s1

Reaction to fire classification: B₁ - s1

SGS

Test Report

NO.: ENPH2104000111FF Date: Apr. 27, 2018 Page 3 of 6

IV. Classification and field of application:

a) Reference of classification

This classification has been carried out in accordance with EN 13501-1:2018. The relevant technical characteristics for the performance are given in Annex A.

b) Classification

The product, in relation to its reaction to fire behaviour is classified:

EN 13501-1	EN 13501-2
Classification	Classification

c) Field of application

This classification is valid for the following field of application:

- With an airgap, fire resistance
- Fixed combustibles
- Horizontal and vertical insulation
- Free standing
- Class B1 (flame and smoke spread)

fire resistance

EN 13501-1

decking

class Bfl-s1

beams

class B-s1-d0

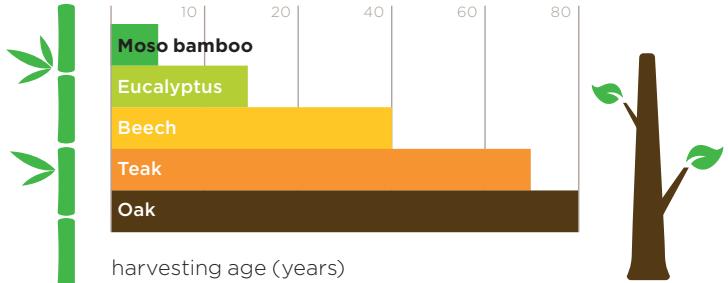
Bamboo N-durance[®]: the sustainable choice

MOSO[®] Bamboo N-durance[®] offers sustainable advantages. The inclusion of Bamboo N-durance[®] 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 N-durance[®] and other MOSO[®] products in many sustainable reference projects all over the world.

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 MOSO[®] Bamboo N-durance[®], while large amounts of CO₂ are captured in the bamboo forests and products (www.inbar.int/understanding-bamboos-climate-change-potential).



the sustainability of Bamboo X-treme®

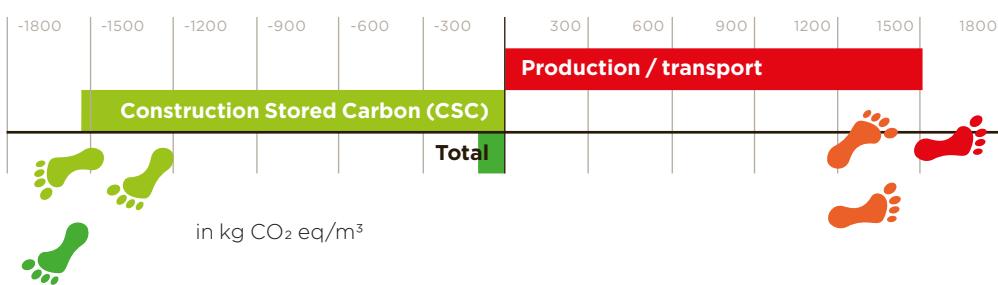
MOSO® Bamboo X-treme® offers clear sustainable advantages and is even proven to be CO₂ neutral during the product lifespan! The inclusion of Bamboo X-treme® contributes to a higher LEED, BREEAM, Green Star, HQE and DGNB certification score for green building projects. That's one of the reasons why you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

carbon footprint

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

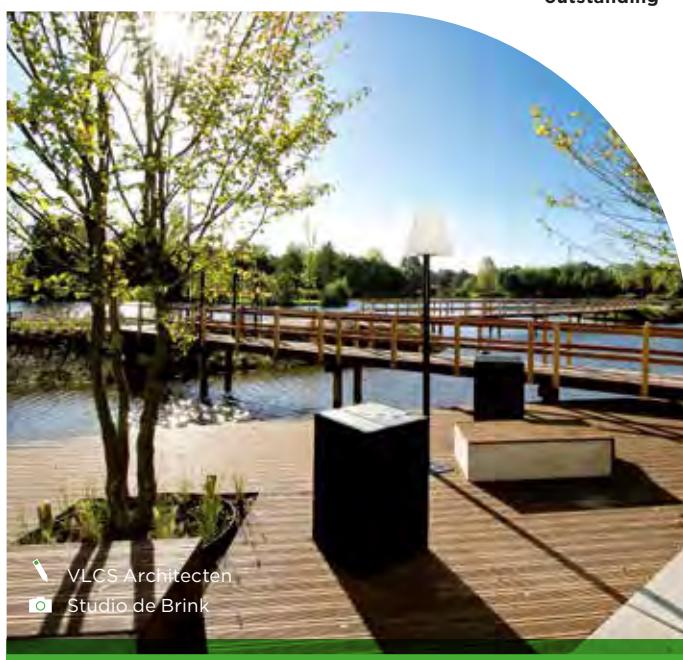
MOSO® has conducted several LCA studies, including carbon footprint studies, together with Delft University of Technology (TU Delft) and NIBE (LCA experts). The 2015 LCA report, available at www.moso-bamboo.com/lca, was the first of its kind and resulted in many new findings about the carbon footprint 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.



Venco Campus BREEAM

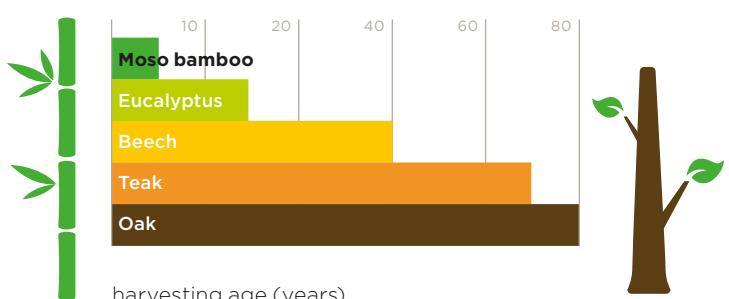
Eersel, the Netherlands



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 MOSO® Bamboo X-treme®, while large amounts of CO₂ are captured in the bamboo forests and products (www.inbar.int/understanding-bamboos-climate-change-potential).

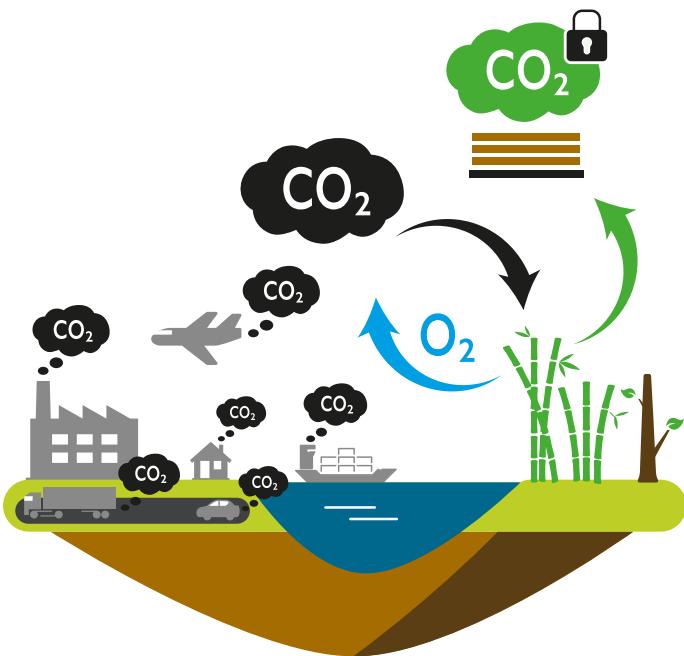




carbon storage in bamboo

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



breeam
★★★★★
outstanding

HQE®

Tour Saint Gobain - La Défense

LEED / BREEAM / HQE - (1000 m²) Paris, France



Contributes to
the leading green
building certification
programs worldwide



DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen
German Sustainable Building Council

Fünf Morgen Dahlem Urban Village
(1750 m²) Berlin, Germany

MOSO® Bamboo X-treme® user information

appearance and colour

MOSO® 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 Sikkens Cetol WF 771 finish (Ipé colour) or a comparable waterbased finish with Ipé colour pigments.

Directly after installation, 1 coat of Sikkens Cetol WF771 is recommended for the unfinished version. For further details see the installation instructions. MOSO® 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.

swimming pool

If MOSO® Bamboo X-treme® outdoor decking is to be used around swimming pool areas, the following has to be taken into account: MOSO® Bamboo X-treme® is a natural (wood like) product. As with any wooden product used outdoors, there is always a risk of formation of splinters, however splinters from MOSO® Bamboo X-treme® are normally smaller than (tropical) hard wood splinters. A regular application of a finish (more frequently necessary around swimming pools) is required to reduce the formation of splinters. Furthermore, regular maintenance with the silicon carbide broom or disk is required to effectively remove splinters and smooth the surface. The boards must be installed in such a way that the surface water cannot flow directly into the pool. Also bear in mind that treated swimming pool water contains salt and chlorine which can cause the boards around the pool to "weather" and become bleached faster than the boards in areas not exposed to the swimming pool water.

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 MOSO® 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 discolouration of surrounding or underlying building components.

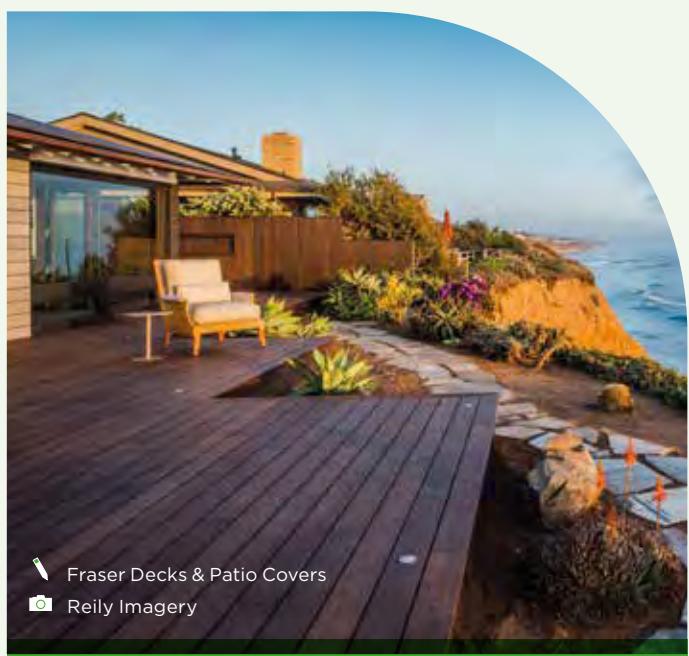
wet condition



dry condition



Private Residence Solana Beach low clearance decking installed near a cliff edge by the sea - (325 m²) California, USA



Endless
possibilities with
MOSO® Bamboo
X-treme®



Altmühltherme Wellness decking with FSC® certification installed on a steel structure - (1000 m²) Treuchtlingen, Germany



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

▼ Mayslits Kassif Architects
📷 Lior Teitler

2.5 km Central Beach Promenade photo taken 3 years
after installation - (700 m²) Tel Aviv, Israel

Public Elementary School “IKC” photo taken 5 years
after installation - (320 m²) Amsterdam, The Netherlands



Riberach Hotel photo taken 8 years after installation
(1.200 m²) Bélesta, France

Hotel Marqués de Riscal

(900 m²) Álava, Spain



César Caicoya
Aitor Ortiz

Water Authority Limburg

(600 m²) Roermond, the Netherlands



MVD Architecture
Awood

Marine Dock Candlewood Lake

(55 m²) Mount Gilead, Ohio, USA



Ron Turner Studios



see the ease of installation, cleaning and maintenance of **MOSO® Bamboo X-treme®** at:
www.moso-bamboo.com/youtube/x-treme

Headquarters:

Moso International B.V.
Adam Smithweg 2
1689 ZW Zwaag
the Netherlands
T +31 (0)229 265 732
info@moso.eu

Spain, France, Portugal, North Africa,
Latin America and Middle East:

Moso Europe S.L.U.
C/ Pau Claris, 83 - Principal 2^a
08010 Barcelona
Spain
T +34 (0)93 574 9610
contact@moso.eu

North America:

Moso North America Inc.
PO Box 793, 1741 Valley Forge Road
Worcester, PA 19490
United States of America
T +1 855 343 8444
info@moso-bamboo.com

Sub-Saharan Africa:

Moso Africa Pty. Ltd.
7 Glosderry Road Kenilworth
7708 Cape Town
South Africa
T +27 2167 11214
contact@moso-bamboo.co.za

Gulf Cooperation Council
(GCC) Countries:

Moso Middle East LLC
Office G-058, Techno Hub 1,
Silicon Oasis, Dubai
United Arab Emirates
T +971 4 258 9337
contact@moso-bamboo.ae

Italy:

Moso Italia S.R.L.
Via Antonio Locatelli 86
20853 Biassono (MB)
Italy
T +39 (0)39 900 5440
mosoitalia@moso.eu

Headquarters:

Moso International B.V.
Adam Smithweg 2
1689 ZW Zwaag
The Netherlands
T: +31 (0)229 265 732
info@moso.eu

Spain, France, Portugal, North Africa,
Latin America and Middle East:

Moso Europe S.L.U.
C/ Pau Claris, 83 - Principal 2^a
08010 Barcelona
Spain
T: +34 (0)93 574 9610
contact@moso.eu

North America:

Moso North America Inc.
PO Box 793, 1741 Valley Forge Road
Worcester, PA 19490
United States of America
T: +1855 343 8444
info@moso-bamboo.com

Sub-Saharan Africa:

Moso Africa Pty. Ltd.
7 Glosderry Road Kenilworth
7708 Cape Town
South Africa
T: +27 2167 11214
contact@moso-bamboo.co.za

Gulf Cooperation Council
(GCC) Countries:

Moso Middle East LLC
Al Jafla-B, Ras Al Khor Industrial 1
P.O. Box: 384421, Dubai
United Arab Emirates
T: +971 4 258 9337
contact@moso-bamboo.ae

Italy:

Moso Italia S.R.L.
Via Antonio Locatelli 86
20853 Biassono (MB)
Italy
T: +39 (0)39 900 5440
mosoitalia@moso.eu

www.moso-bamboo.com

 Pedro Machado

 MOSO

