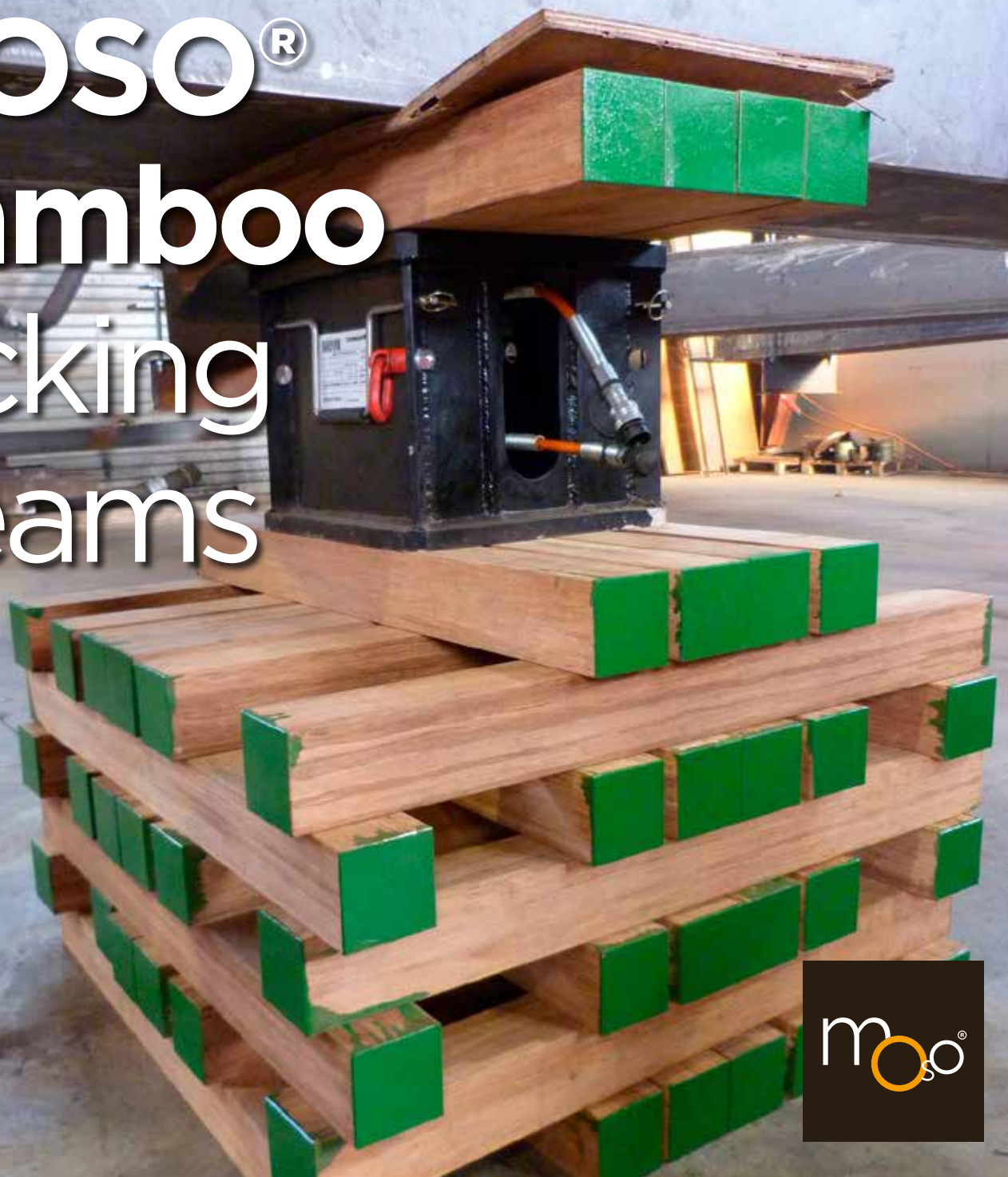


MOSO[®] bamboo jacking beams



m_{oso}[®]



the advantages of MOSO® bamboo jacking beams

Bamboo is very sustainable, ecological and the fastest growing raw material on earth. In addition, engineered bamboo construction 'timber' has very good mechanical properties, making it ideal for heavy duty applications. Since the use of hardwood from endangered tropical forests has become an increasing concern for many industries, MOSO® worked together with Mammoet, the world's largest service provider specializing in engineered heavy lifting and transport, to develop the right bamboo material that can replace their need for tropical wood. After extensive operational and quality assurance testing, these jacking beams are now also available for use by other companies, for heavy lifting and transport operations and other practical applications. Bamboo Jacking Beams offer multiple advantages:



hard and stable

- Compression strength similar or better compared to Azobe.
- Brinell hardness > 9,5 kg/mm²
- The mechanical properties exceed those of the commonly used hardwoods.
- Considerably higher stability than all other woods thanks to the engineering of the material.



renewable raw material

- Made from Moso bamboo; with a growing speed of up to 1 metre per day the fastest growing plant on earth.
- Ready for harvest after 5 years (compared to up to 100 years for hardwood species) - no deforestation.
- Consisting of approx. 90% natural bamboo.



CO₂-neutral

- Official LCA and carbon footprint studies by Technical University Delft according to ISO 14040/44 confirm that MOSO® solid bamboo products are CO₂ neutral over the full life cycle.
- The use of bamboo contributes to a higher score in LEED-, BREEAM and Green Star certified projects.



„Mammoet will only order bamboo jacking beams from now on. As the global market leader, Mammoet realizes there is a need to use resources responsibly to minimize our impact on the environment. This is why we are replacing azobé with bamboo jacking timbers. This decision fits with Mammoet's belief in continuously raising standards within our profession and working to move the world towards a more sustainable future.“

Jan Kleijn

Chief Operating Officer Mammoet

Schiedam, the Netherlands

the production of MOSO® bamboo jacking beams

The fast growth and abundant availability makes bamboo a perfect source for many applications. 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. Furthermore, the final requirements of bamboo material, like an improved compression strength, define the production steps required. In the development of the Jacking Beams, the tropical wood species Azobe was a reference to determine the required compression strength. Let us explain how we get from the raw bamboo material to the final product, MOSO® Bamboo Jacking Beams.

harvesting after
5 years



modify the bamboo strands
with a carbonization process



finally creating the final
dimensions and surface



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



compressing
the strands into
High Density®
material



MOSO® Bamboo Jacking Beams material more stable, harder and stronger than azobe and other tropical woods.

stem to strands

After harvesting, the mature Moso bamboo stems are split in a longitudinal direction and the outer skin is removed. The strips are then crushed by using a number of incision rollers which slice gaps into the strips and then (by pressure) grind the strips to loose strands. The untreated strands have a light yellow colour.

thermal treatment

In several steps, the strands are heated up in the presence of a saturated steam (to protect the wood from charring or burning) and cooled down. During processing, the moisture content and sugar content change. Furthermore, this process changes the colour of the bamboo from white/yellow to 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 at a very high pressure, to cure the glue. The output is an oversized beam, which is profiled to get the required shape.

High Density®

We call the compression of bamboo strands a Density® process. It increases the density from 650-700 kg/m³ to approx. 1.150 kg/m³ and improves the hardness of the material significantly. After pressing, the material is stronger and harder than almost any other hardwood in the world.

„MOSO® works together with factories as co-producer. In China, MOSO® has an office that fullfills the need of inspection and quality assurance. MOSO® China has full access to the production sites.

The co-production consists of:

- 1. Determining the requirements per product related to application, environment and regulations;*
- 2. Determining the production steps to reach the quality and requirements;*
- 3. Supervising the factories in each production step, including final inspection before shipment.”*

Arjan van der Vegte

R&D Manager MOSO® International BV

MOSO® bamboo jacking beams

quality control & testing

The quality control / inspection executed by MOSO® can be divided in two approaches:

1. Material preparation stage

MOSO® makes regular (at random) checks before and during production, which are primarily meant to assure that the factory follows the correct production procedures. This means that MOSO® supervises the processing steps (at random), checks the base materials, and corrects when clear divergences are found.

Testing compression strength

Compression strength is one of the most important features for the use and performance of jacking beams. Each batch of MOSO® Bamboo Jacking Beams is tested according to a detailed protocol. In the development of the product, the properties of Azobe Jacking Beams are used as reference. The minimum compression for jacking beams are defined together with Mammoet and can be altered on demand.

Samples for testing

A minimum of 10 oversized beams are taken randomly from the production batch. A production batch is one run of production without interruption for the production of other products. The volume of one production batch is maximum one 20 ft container. A minimum of 10 oversized beams from each additional container are taken if the production batch is over one 20 ft container.

From all the randomly taken oversized beams, 2 samples are taken for testing, with the dimensions 200x100x100 mm. One sample from the middle of the beam and one sample from the end of the beam brings the the total for each batch at 20 samples. Half of these samples are tested vertically and half of these samples horizontally.

Expression and judgement of results

When adding more force on the sample, the compression / movement (indentation) of the sample is recorded. Results are noted at each step of 5T = 50kN more force. The average of the samples (end & middle, horizontal & vertical) is calculated and compared with the maximum allowed compression (indentation) as given in the table below. When results of the tested samples are above given reference values, the batch of beams has to be considered as not approved. When results of the tested samples are similar or below given reference values, the batch of the beams has to be considered as approved. Results of the internal testing of the MOSO® Bamboo Jacking Beams on compression strength are recorded per batch and can be made available to the customer on request. The results of the testing on batches produced in 2019 is visible in the graph.

2. Production stage

In the final product stages of the production, MOSO® will execute real tests on the half or final products, to assure that these products can fulfill the quality requirements as specified and as needed for the final application. This type of production control and related test results are recorded by MOSO®.

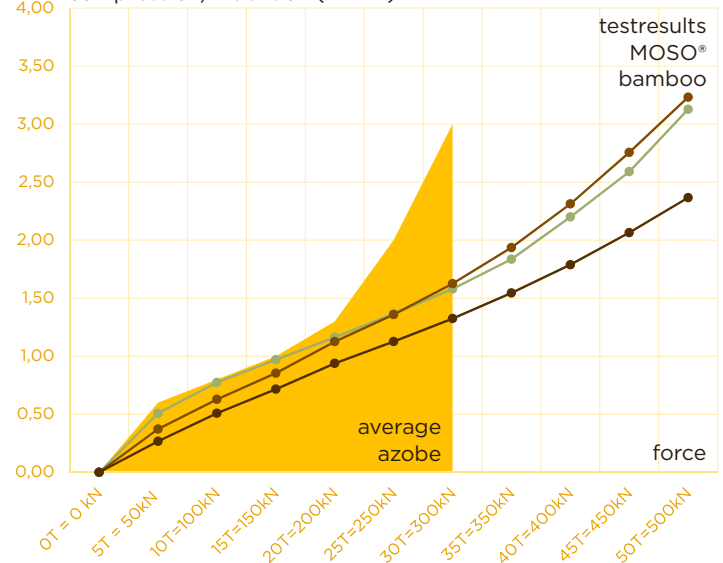
Test setup

A compression test setup is available, in which the bamboo sample will be placed between 100x100x20 mm steel plates, straight above each other in the middle of the sample. In the exact vertical direction there will be a force applied, starting at 0T=0kN going up in steps of 5T=50kN up to 35T=350kN and continue until breakage of the sample starts. The test stops when earlier breakage takes place or when 60T=600kN has been reached.



Test results batches produced in 2019

compression/indentation (in mm)



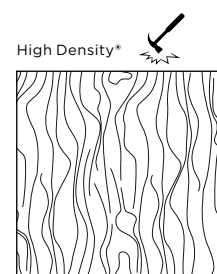
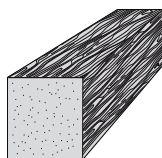
Reference average max. compression/indentation in MOSO® Bamboo Jacking Beams test

force	0T=0 kN	5T=50kN	10T=100kN	15T=150kN	20T=200kN	25T=250kN	30T=300kN	> 35T=350kN
max. compression/indentation	0 mm	0,60 mm	0,80 mm	1,00 mm	1,30 mm	2,00 mm	3,00 mm	no requirement

MOSO® bamboo jacking beams

technical datasheet

MOSO® Bamboo Jacking Beams are made of the fastest growing plant on earth. Bamboo strips are compressed and glued under high pressure, creating a High Density® material that is even harder than the best tropical hardwood species. With the development of the Jacking Beams, bamboo can now be used in many heavy duty supporting and lifting applications. The Jacking Beams are thoroughly tested for various mechanical properties like compression strength and bending. Compared to normal bamboo beams additional efforts were made to define the right type of strips, type of glue, density, etc. The standard length of the MOSO® Bamboo Jacking Beams is 1050 mm and the beams have a cross section of 100x100 mm for easy calculation of stacking requirements at each support point. For filling smaller gaps to a required height, additional blocks are available in different thicknesses.



Caramel	Style	Bevel	Dimensions (mm)
BL-DT3050	High Density®	R = 2 mm	1050x100x100
BL-DT3051	High Density®	R = 2 mm	1050x100x50
BL-DT3052	High Density®	R = 2 mm	1050x100x30
BL-DT3053	High Density®	R = 2 mm	1050x100x20
BL-DT3054	High Density®	R = 2 mm	1050x100x10

technical characteristics and certifications

- Density (Product): 1100-1200 kg/m³
- Resistance to Indentation - Brinell Hardness: ≥ 9.5 kg/mm² (EN 1534)
- Reaction to fire: Class B-s1-d0 (EN 13501-1)
- Formaldehyde emission: Class E1 (< 0,124 mg/m³) (EN 717-1)
- Modulus of Elasticity in bending: 12600 N/mm² (EN 310)
Bending strength: 95 N/mm² (EN 310)
- Modulus of Elasticity in compression: 1.6 kN/mm² (EN 408)
Compression strength: 30 N/mm² (EN 408)
- Use Class: Class 3 (EN 335)
- CO₂ neutral: LCA report TU Delft (ISO 14040/44) (www.moso.eu/lca)
- Environmental Product Declaration - EPD (EN 15804) (www.moso.eu/epd)



about MOSO®

MOSO International was founded in the Netherlands in 1997. Since then, MOSO® has evolved to become the unchallenged European market leader in the development of innovative and sustainable bamboo products for interior and exterior applications.

There is no other company worldwide with an equally – and still expanding - **broad assortment** in **high quality** bamboo products. MOSO's head office, with the **biggest bamboo warehouse** in Europe, is located near Amsterdam. Furthermore, MOSO® has offices in Barcelona, Milan, Cape Town, Pennsauken (USA), Dubai and Hangzhou (China). MOSO® works with several partner companies and leading distributors worldwide to **guarantee the availability** of MOSO® products in each region.

Besides the MOSO® Bamboo Flooring and MOSO® Outdoor product groups, MOSO® offers a very broad assortment of **Bamboo Panels, Veneer** and **Beams** in many sizes, thicknesses, colours and textures. These products are used worldwide in many applications including wall covering, ceilings, window frames, doors, stairs, furniture and kitchens, providing an ideal combination with the MOSO® flooring assortment.

Furthermore, because of its expertise, MOSO® is able to develop **unique, customised bamboo solutions** for industrial clients, meeting exceptionally stringent requirements. Through its experience, innovative attitude and world-wide network, MOSO® is recognised as the **global A-brand** in bamboo products. The proof is the impressive list of references and clients such as Madrid Airport, BMW, AkzoNobel, Texaco, Guggenheim Museum, Rabobank, United Nations (FAO), Iberostar and CitizenM Hotels.

For an overview of our references and clients please visit our website: www.moso-bamboo.com/references.

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MOSO® customised solutions

MOSO® develops and offers a wide range of customised specialties, such as **ceiling boards, traffic signs and stable planks**.

For more information please contact us: info@moso.eu

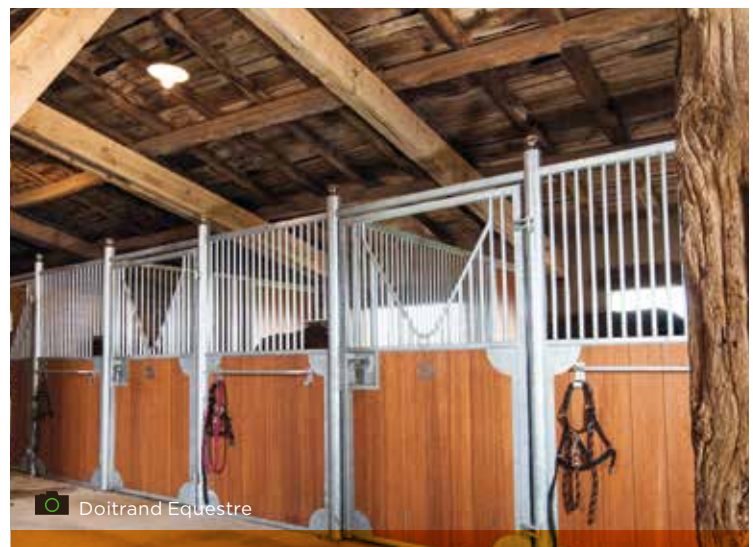
► www.moso.eu/unlimited-solutions

Rogers Stirk Harbour + Partners - Estudio Lamela Arquitectos

Bamboo Ceiling board
(200.000 m²) International Airport Madrid, Spain



Bamboo Traffic Sign
Developed with HR Groep, the Netherlands



Doitrand Equestre

Bamboo E-quine stable planks
Doitrand Equistre Stable in Alsace Corrèze, France



More information about
MOSO® Bamboo Jacking Beams at:
www.moso.eu/jacking-beams



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