



# **The Driving Role of Architects in Bamboo Product Innovations - the MOSO experience**

**Dr. ir. Pablo van der Lugt - MOSO International | AMS institute – TU Delft**

# Where it all started...



# MOSO® Mastering Bamboo

With 25 years' experience in the relatively young bamboo industry, MOSO® is recognised as the global A-brand in bamboo because of its focus on product quality, innovation and sustainability.



# Booming Bamboo

**The (re)discovery of a sustainable material with endless possibilities**

- Published by MaterialDistrict
- Supported by MOSO International

[www.boomingbamboo.com](http://www.boomingbamboo.com)



m<sup>o</sup>so<sup>®</sup> Mastering  
bamboo



**Figure 2.17**  
Perpetual wood cycle

One hectare of well-managed production forest can replace good ground in the EU (can provide enough material to produce three large timber houses, containing 2 cubic metre (m<sup>3</sup>) and a large amount of wood-based products) (based on relatively high-yield species such as Douglas fir and a conservative replacement conversion rate) – complete background calculation available!

**PERPETUAL WOOD CYCLE**  
1ha = 3 TIMBER HOUSES  
+ 1kg of FINISHING

42

**Early timber industry**  
In the 19th century, timber was the leading option in shipbuilding. One of the key success factors was the invention of the steam sawing mill. One of them, De Egel in Blij, the Netherlands, is still active. Sourced by the Wood Museum designed by Oude.

**Industrial Revolution**  
During the Industrial Revolution, coal started to replace wood as fuel source. This also initiated the mass production of iron and steel, increasingly substituting timber as construction material. The adoption of steel as building material gained traction after the Second World War and has remained popular ever since.

Concrete became the most commonly used building material because of its availability, affordability and durability. It has been used already since Roman times, with the Pantheon as the best-known example from that time. In the 18th century, lime mortar was replaced with mortar based on Portland cement, which is able to set under wet conditions. Currently, cement is under increasing public pressure because of its high carbon footprint.

79

**#1 resource scarcity**





**44% of extracted materials**

are used in the built environment

## Years left?

Tropical hardwood



Oil (PVC)



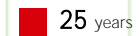
Bauxite (Aluminium)



Iron (Steel)












Copper



2000 2100 2200 2300 2400 2500



## Harvesting Age

Bamboo		 4 years
Pine		 30 years
Oak		 80 yrs
Iron		X
PVC		X
Alum.		X

#2 climate change

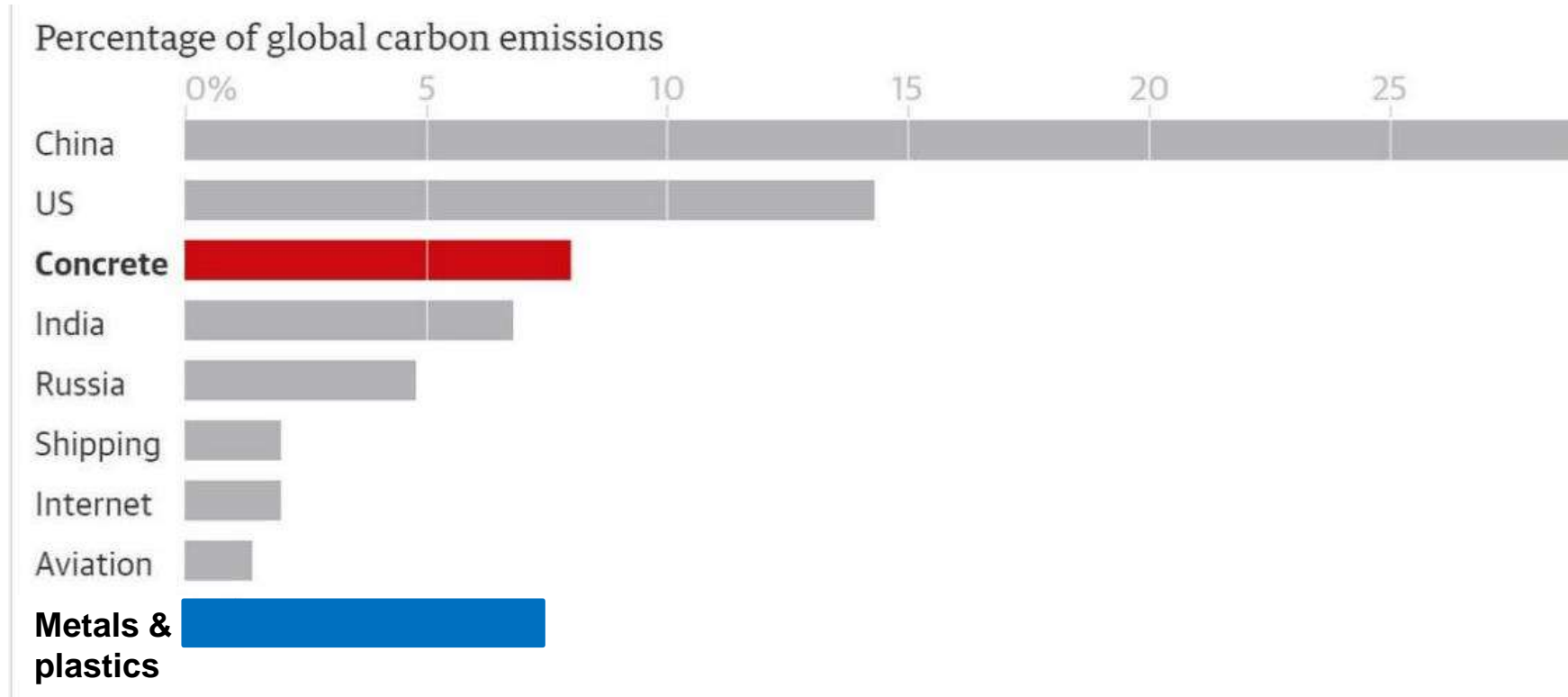




**39% of greenhouse gas emissions**

are caused by the built environment

# If concrete & steel were countries...



Credit: the Guardian (source: UNEP, Chatham house),  
figures for metals & plastics from Ellen MacArthur Foundation (2019)

# Materials CO2 pyramid

| GWP [kg CO<sub>2</sub> eq / m<sup>3</sup>]  
| fase A1-A3

| scroll ned til "BEREGNEREN"

| vælg materialer i pyramiden. DML har af-  
| holdt alle data i beregningen





Hotel Jakarta | Amsterdam, the Netherlands | SeArch

Photo: Lior Teitler for MOSO International



Hotel Jakarta | Amsterdam, the Netherlands | SeArch

Photo: Derix group







**CO<sub>2</sub> + H<sub>2</sub>O + solar energy → glucose + O<sub>2</sub>**

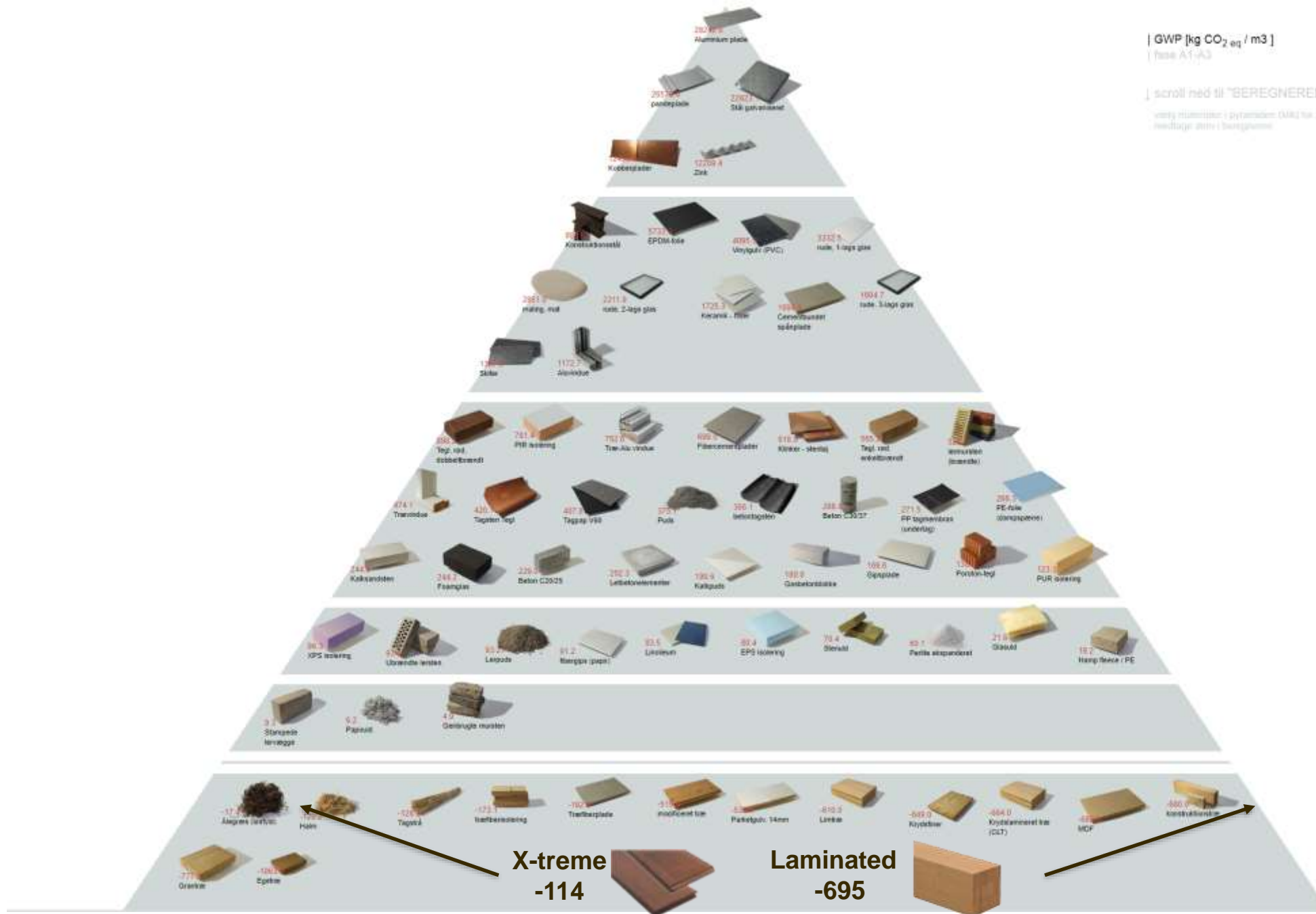


**CO<sub>2</sub> + H<sub>2</sub>O + solar energy → glucose + O<sub>2</sub>**

| GWP [kg CO<sub>2</sub> eq / m<sup>3</sup>]  
| fase A1-A3

| scroll ned til "BEREGNEREN"

| vælg materialer i pyramiden. GWP'erne af  
| hver type er vist i beregneren



# CPD's – architectural session



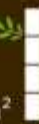
# Why do you work with bamboo?



**MOSO®**  
bamboo veneer

**Adolfo Suarez  
International Airport**  
Madrid, Spain

 Rogers Stirk Harbour  
+ Partners 

200.000m<sup>2</sup> 

**moso®**

**MOSO® bamboo  
panels & beams,  
bamboo industriale**


**CityLife Shopping Mall**  
Milan, Italy

-  Zaha Hadid Architects
-  Antinori
-  6500 m<sup>2</sup> flooring, 2500 m<sup>2</sup> panels, 70.000 m<sup>1</sup> beams



**MOSO® bamboo  
panels & beams,  
bamboo industriale**

**CityLife Shopping Mall**  
Milan, Italy

 Zaha Hadid Architects

 Antinori

 6500 m<sup>2</sup> flooring, 2500 m<sup>2</sup>  
 panels, 70.000 m<sup>1</sup> beams

**moso®**



flooring, panels,  
beams and veneer

**Hotel Jakarta**  
Amsterdam,  
the Netherlands

SeARCH  
Lior Teitler  
2.750 m<sup>2</sup> Elite, 7.743 m<sup>2</sup> veneer,  
540 m<sup>2</sup> panel, 35.000 m<sup>1</sup> beams



**MOSO® bamboo elite  
flooring, panels,  
beams and veneer**

**Hotel Jakarta**  
Amsterdam,  
the Netherlands

- SeARCH
- Lior Teitler
- 2.750 m<sup>2</sup> Elite, 7.743 m<sup>2</sup> veneer,  
540 m<sup>2</sup> panel, 35.000 m<sup>1</sup> beams



# MOSO Ultra Density



3-6-2022

m<sup>o</sup>s<sup>o</sup>® Mastering  
bamboo

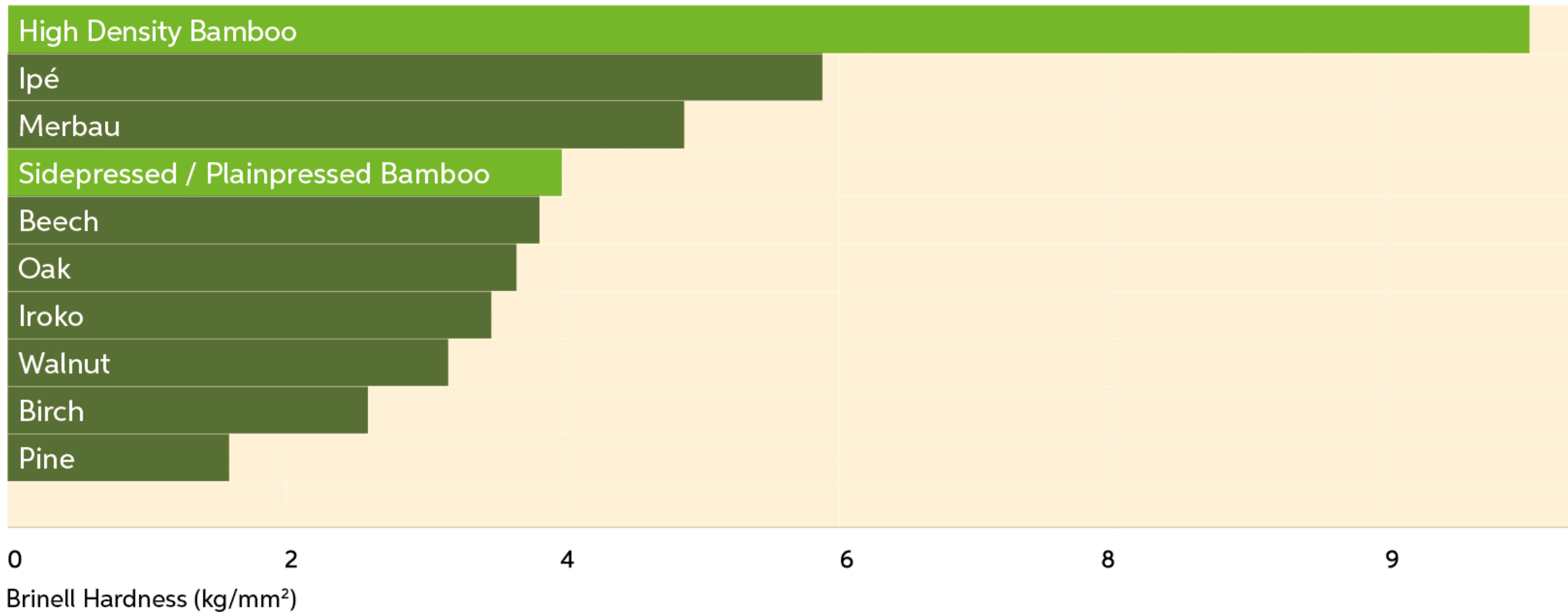
# Paris Gare du Nord

- Project circumstances:
  - Approximately 200 million passings a year.
  - Tough circumstances: dirt, moisture, food/drink spills.
  - French requirements (testing / certification mandatory – Atex) to prove various parameters (fire resistance, wear resistance, reduced slipperiness, durability, etc).
- Bamboo product solution
  - Specific development of extremely densified extra thick bamboo boards (UltraDensity<sup>®</sup> boards) on top of thermally modified subbeams (Bamboo X-treme).
  - Total system certified for Atex approval (French requirement): large time and money investment due to high requirements.



# Hardness comparison

## Brinell (kg/mm<sup>2</sup>)



**MOSO® bamboo  
ultradensity® flooring  
and stairs**

**Gare du Nord**  
Paris, France

AREP  
David Ducastel

1.500 m<sup>2</sup>



**MOSO® bamboo  
ultradensity flooring  
and stair panel**

**Gare du Nord**  
Paris, France



AREP

David Ducastel - Philéas Fotos

The logo for MOSO, featuring the lowercase letters 'm' and 'so' in a white, sans-serif font. The letter 'o' is replaced by a green circle with a white outline, and a small registered trademark symbol (®) is positioned to the upper right of the 'o'.

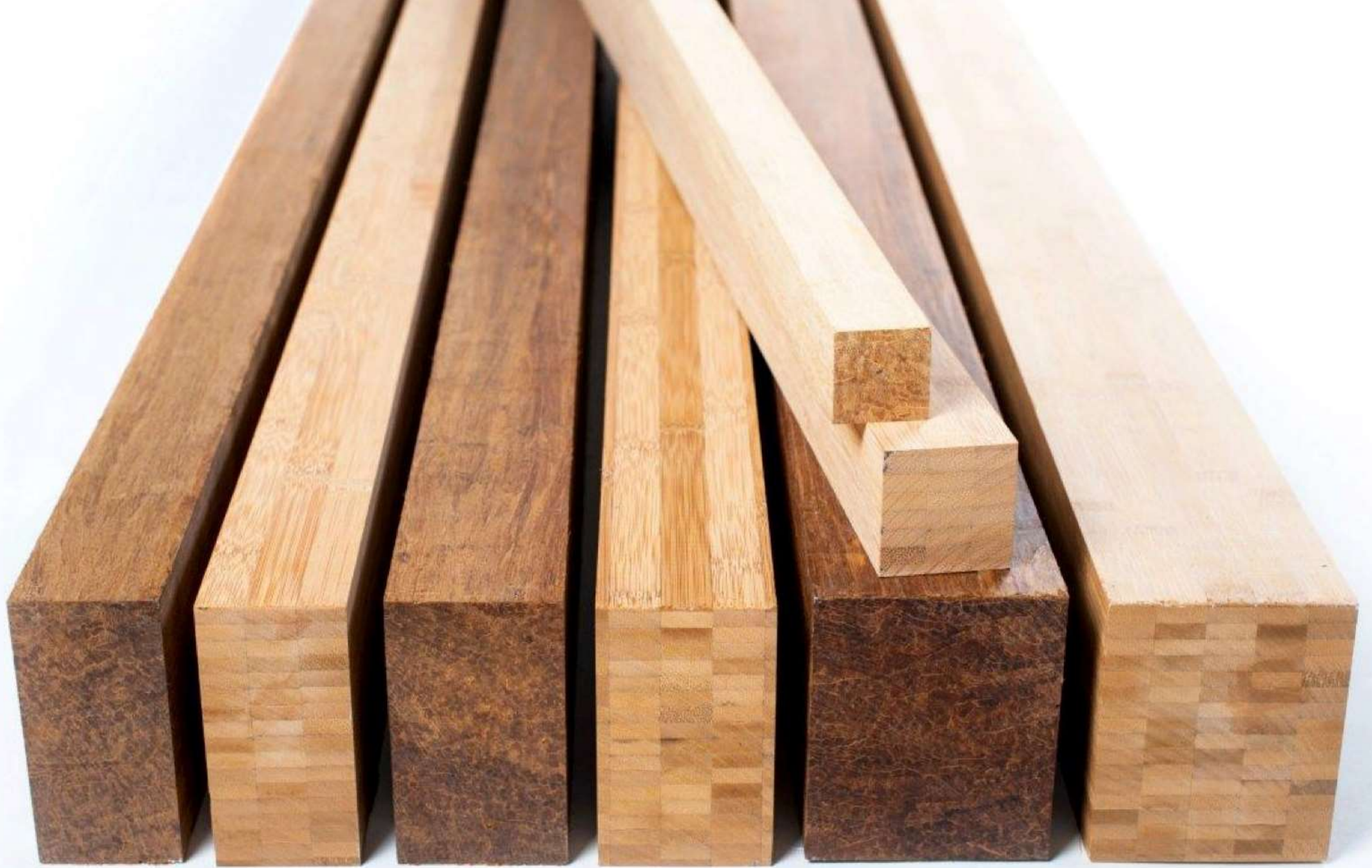


Photo: Remco van den Top



# MOSO Bamboo N-finity Indoor



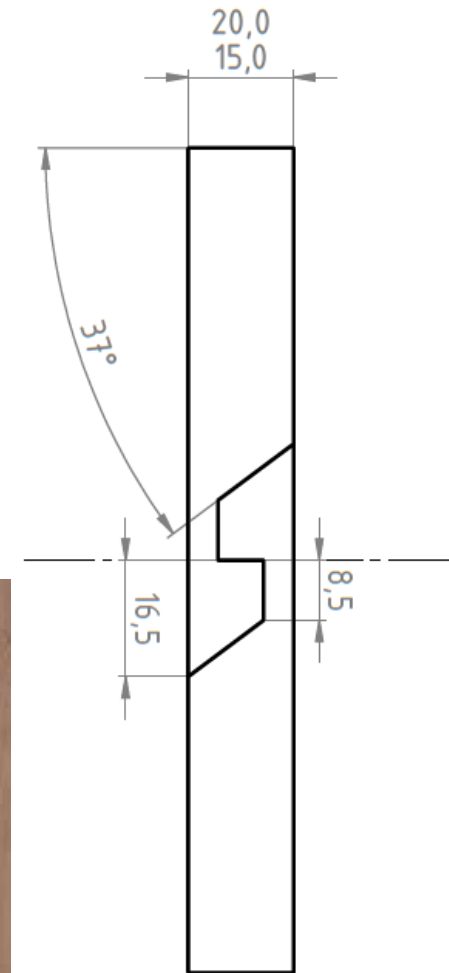
3-6-2022

m<sup>o</sup>so<sup>®</sup> Mastering  
bamboo



# MOSO Bamboo N-finity Indoor

- Solid bamboo beams with max. dimensions 12.000 x 200 x 120 mm
- Finger jointed on strip level
- D4 waterproof glueing



# N-finity architectural co-development

- Solar Carport development for BMW (2012)
- Brainstorm session with director BMW design and involved Architects (Archibrand).
- Outcome: Curtain Walls, Window frames, Wintergarten, etc.
- Project Archibrand : Klöckner Pentaplast Montabaur (DE)



BMW solar carport



Klöckner Pentaplast Montabaur



Mastering  
bamboo

# MOSO Bamboo N-finity Indoor

- Bamboo beams suitable for structural and non-structural applications
- Structural properties tested by Universities of Cambridge and Graz
- First bamboo construction material with DIBt\* General Construction Approval



\*German institute for building technology



Mastering  
bamboo

**MOSO®  
bamboo n-finity &  
bamboo panels**

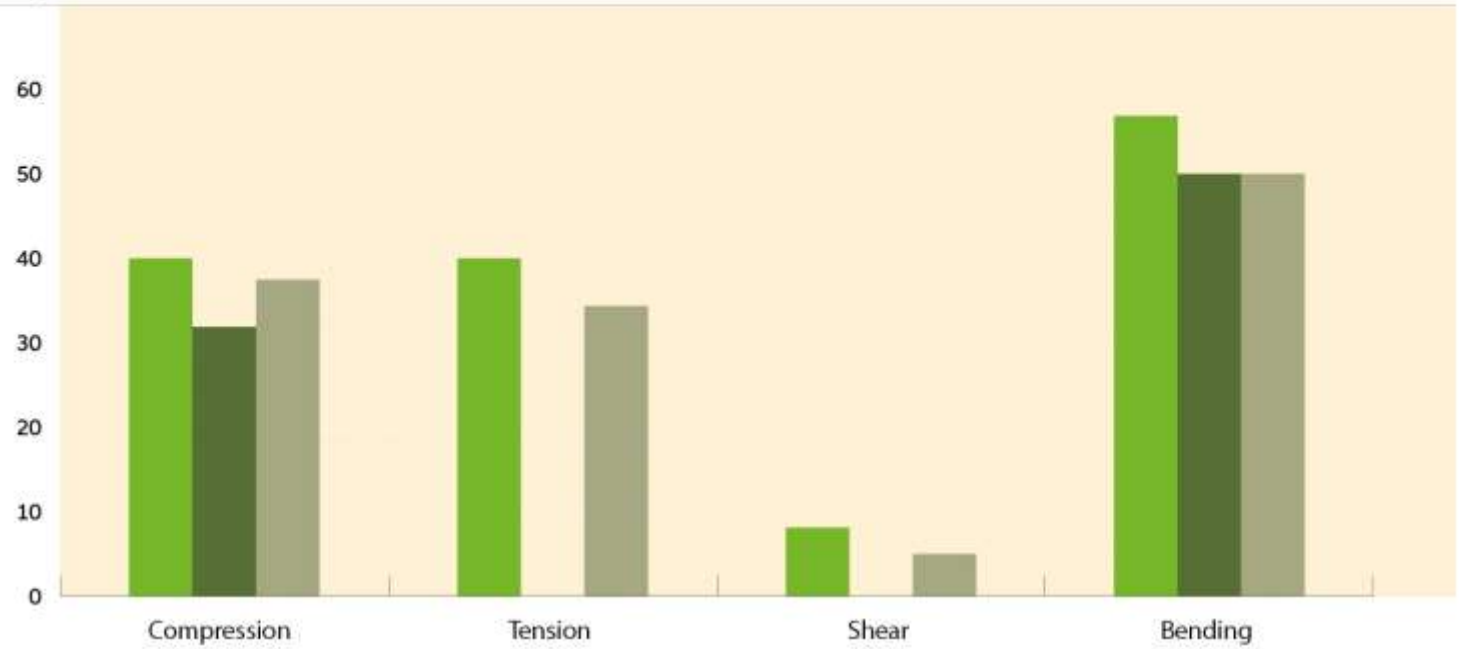
**Klöckner Pentaplast**  
Montabaur, Germany

Archibrand Studio

5300 m<sup>1</sup> beams

- Laminated bamboo (Bamboo N-finity)
- Glue laminated spruce
- Spruce

Average Stress (MPa)



# MOSO Bamboo N-finity Indoor


- excellent bending strength and therefore strength class, relatively low e-modulus/stiffness
- bamboo is bending further but breaks later/less easy
- less suitable for horizontal structural use, however advantage for applications such as curtain walls as aluminium replacement (50 mm)




Mastering  
bamboo

**MOSO®**  
**bamboo n-finity &**  
**bamboo panels**

**Klöckner Pentaplast**  
Montabaur, Germany


 Archibrand Studio

 5300 m<sup>1</sup> beams



**MOSO®**  
**bamboo n-finity &**  
**bamboo panels**

**Klößner Pentaplast**  
Montabaur, Germany

 Archibrand Studio

 5300 m<sup>2</sup> beams



**mOSO®**



# MOSO Bamboo N-finity Indoor

*„Bamboo is for us a sustainable material, which even in direct comparison to wood has the better properties in terms of sustainability, CO<sub>2</sub> bond, strength and resistance. Bamboo in the laminated version is ideally suited for construction components in curtain walls or element facades. Bamboo facades create a warm, pleasant atmosphere, especially in office areas. In combination with bamboo panels and veneers or even parquet, there are numerous design possibilities in interior design to tie in with this atmosphere.“*

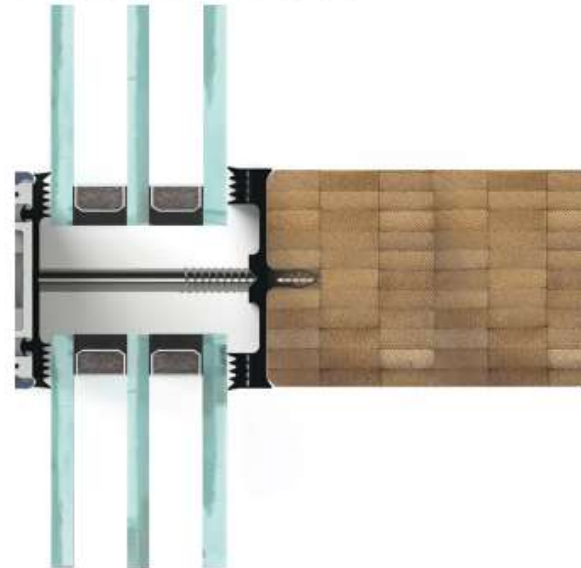
Martin Atzinger - **archibrand**, Munich, Germany



Private house, Immenstadt, Germany  
Stabalux Curtain wall, Bamboo Supreme  
flooring, Design: Archibrand Studio



STABALUX




moso®

Mastering  
bamboo

**MOSO® bamboo  
n-finity indoor beams**

**Private residence**  
Immenstadt i. Allgäu,  
Germany

 Martin Atzinger


 Mathias Kögel


 moso®

**MOSO® bamboo  
n-finity indoor beams**

**Private residence**

Immenstadt i. Allgäu,  
Germany

 Martin Atzinger

 Mathias Kögel



**MOSO® Bamboo  
Products**

**Bridge Pont d'Issy Orange  
Head Office**  
Issy-les-Moulineaux, France



Viguié



Daniel Osso Photographe



moso®



**MOSO® Bamboo  
X-treme® Decking**

**Bridge Pont d'Issy Orange  
Head Office**  
Issy-les-Moulineaux, France



Viguiers



Daniel Osso Photographe





## MOSO® Bamboo X-treme® Cladding

### Speehuis

Oisterwijk, The Netherlands

 Spee architects


 Ossip van Duivenbode

 Awood

The logo for MOSO, featuring the lowercase letters 'm' and 'so' in white, with a green circle around the 'o'.

**MOSO® bamboo  
x-treme beams**

**Oxygen La Défense**  
Paris, France

 Stéphane Malka

 David Ducastel (Phileas Fotos)


 5500 m


**m<sub>o</sub>s<sub>o</sub>®**



# MOSO® Bamboo X-treme® Beams

**Alfonso X Building**  
Madrid, Spain

 Estudio Hans Abaton

 Gradhermetic

m<sup>o</sup>so<sup>®</sup>

# Architect as material and innovation champion





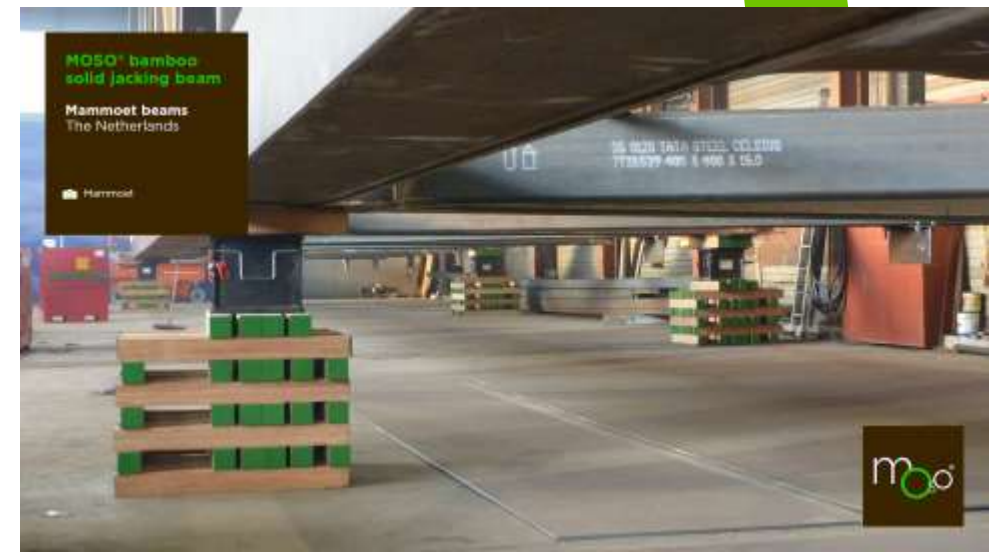
# Outlook

Photo: Guillaume Bonnefont

# Next 25 years?

Move to economies of scale:

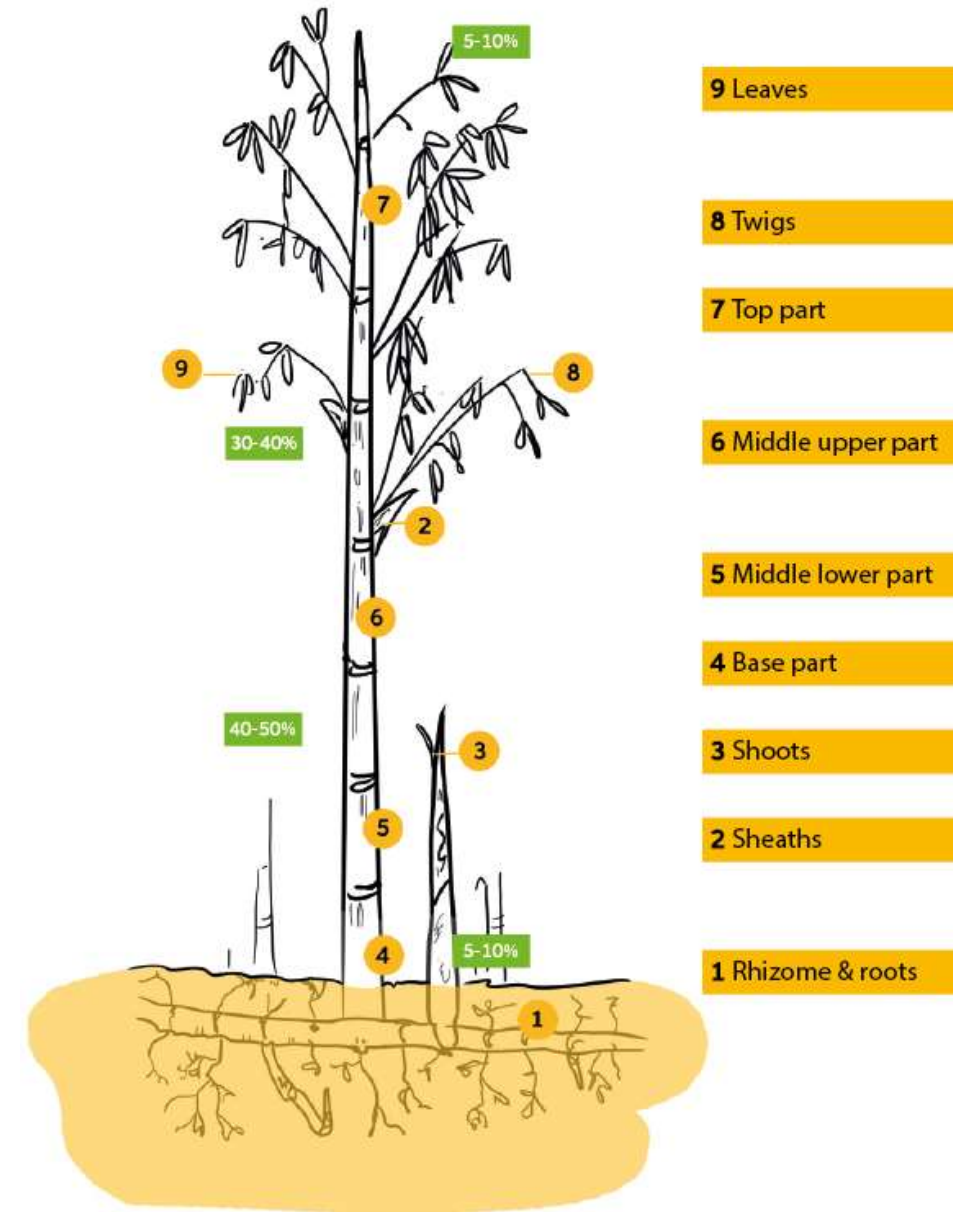
- New outdoor applications (facades, outdoor windows, shutters, etc)
- Structural applications including civil engineering sector
- New bamboo species (Guadua / Asper), local production for local markets
- Bamboo industry in Europe?
- Hybrid bamboo – timber solutions



# Next 25 years?

Move to economies of scale:

- New outdoor applications (facades, outdoor windows, shutters, etc)
- Structural applications including civil engineering sector
- New bamboo species (Guadua / Asper), local production for local markets
- Bamboo industry in Europe?
- Hybrid bamboo – timber solutions



# Next 25 years?

Move to economies of scale:

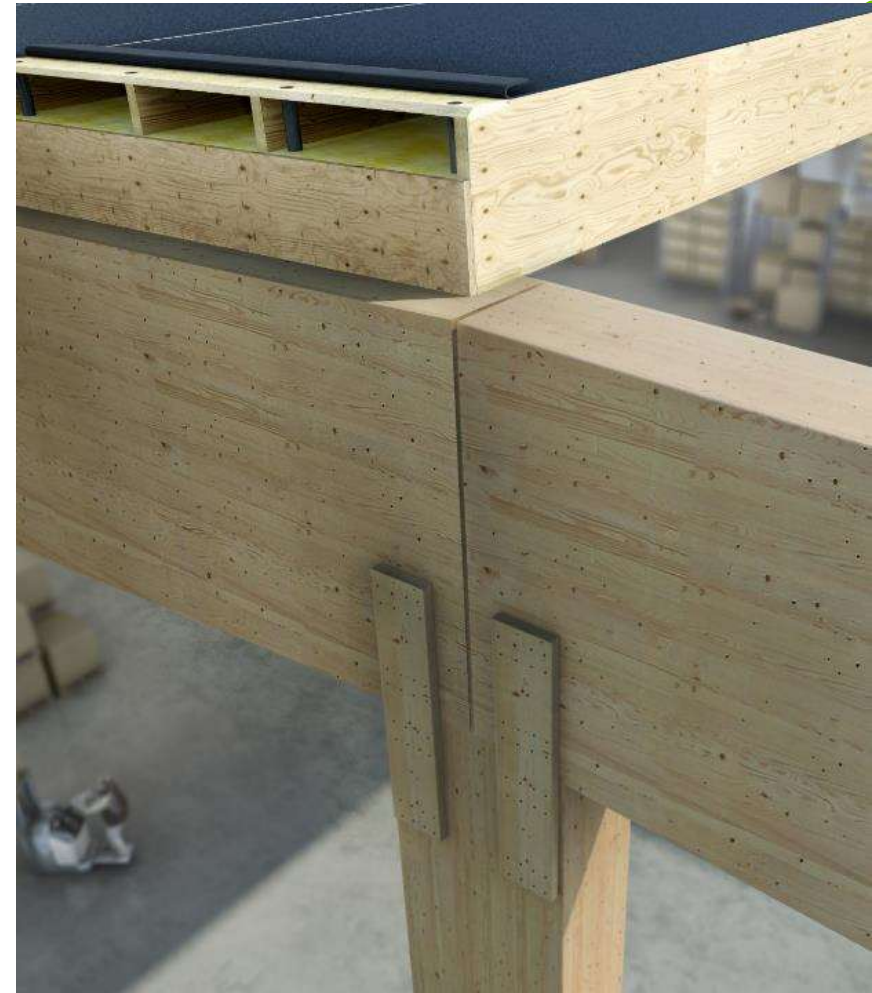
- New outdoor applications (facades, outdoor windows, shutters, etc)
- Structural applications including civil engineering sector
- New bamboo species (Guadua / Asper), local production for local markets
- Bamboo industry in Europe?
- Hybrid bamboo – timber solutions



# Next 25 years?

Move to economies of scale:

- New outdoor applications (facades, outdoor windows, shutters, etc)
- Structural applications including civil engineering sector
- New bamboo species (Guadua / Asper), local production for local markets
- Bamboo industry in Europe?
- Hybrid bamboo – timber solutions



# Next 25 years?

Move to economies of scale:

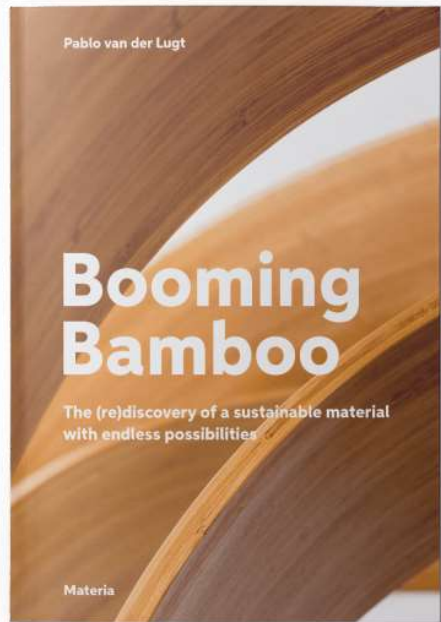
- New outdoor applications (facades, outdoor windows, shutters, etc)
- Structural applications including civil engineering sector
- New bamboo species (Guadua / Asper), local production for local markets
- Bamboo industry in Europe?
- Hybrid bamboo – timber solutions





# Please connect:

[www.linkedin.com/in/pablovanderlugt/](http://www.linkedin.com/in/pablovanderlugt/)



3-6-2022



Mastering  
bamboo

[www.moso-bamboo.com](http://www.moso-bamboo.com)

