Level 1 Term 2

ARCH 109

Building & Finish Materials

waterside cafe with bamboo columns

Who is the architect?

Blooming Bamboo Home

Where is this situated?

By Japanese Architect

K e n g o K u m a

What is it?

In Bali

Designed by I l o r a H a r d y

How high is the structure?

A n a n d a H o u s e

Where?

Bamboo Courtyard Teahouse

The Millenium Bridge

Luum Temple / CO-LAB Design Office

New Pastoralism Lecture Hall

AGA KHAN AWARD 2019

Where and by whom?

H a n d m a d e S c h o o l

Where?


BAMBOO

Physical Properties

- **fastest growing** woody **grass** is **Bamboo**
- **7.5 to 40cm a day**, with **world record being 1.2m in 24 hours in Japan.**
- grows **three times faster** than most other species, that's why available and renewable

Physical Properties

- **Renewable- environment friendly- widely available- cost effective**

- Higher compressive strength than wood, brick or concrete

(The compressive strength of bamboo is 40 - 80 N/mm2 which is twice to four times the value of most timber species)

- tensile strength is competitive with steel

(steel 23000 lbs/sq.in., bamboo 28000 lbs/sq.in.)

- **30% more** oxygen to the atmosphere compared to other plants

- good in **biomass production**.
- rapid control of **soil erosion**
- **Flood resistant houses** in Vietnam
- **Housing for victims of the earthquake** in Nepal
- **Temporary accommodation** in Thailand for Burmese refugees

Why as Building Material?

- It is fastest-growing renewable natural building material.
- The material is easily available & Eco friendly.
- Bamboo is a viable alternative for steel, concrete and masonry as an independent building material.
- It is cost effective and easy to work.

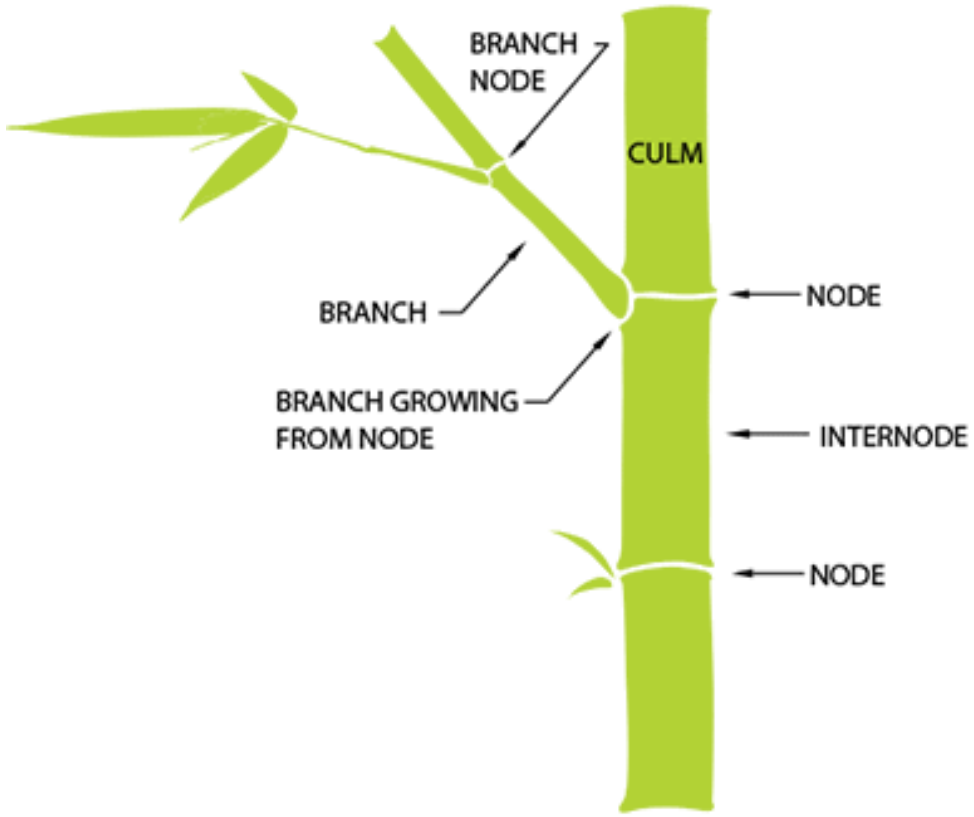
Why as Building Material?

- It can be easily bend, give desired shape and can provide joints to suit the construction.
- Its enormous elasticity makes it a very useful building material in areas with very high risks of earthquakes.
- Local available material to some areas, which tries to carry the local tradition & vernacular Architecture of that place.

Facts

BAMBOO IS USEFUL FOR DIFFERENT PURPOSES AT DIFFERENT AGES

- <30 days – good for eating
- 6-9 months for baskets.
- **2-3 years for bamboo boards or laminations.**
- **3-6 years for construction.**
- >6 years bamboo gradually loses strength up to 12 years old.



Properties

Tensile Strength

Compressive Strength

Elastic Modulus

-Enormous elasticity makes it a very useful building material in areas with very high risks of earthquakes.

Properties

Anisotropic Properties

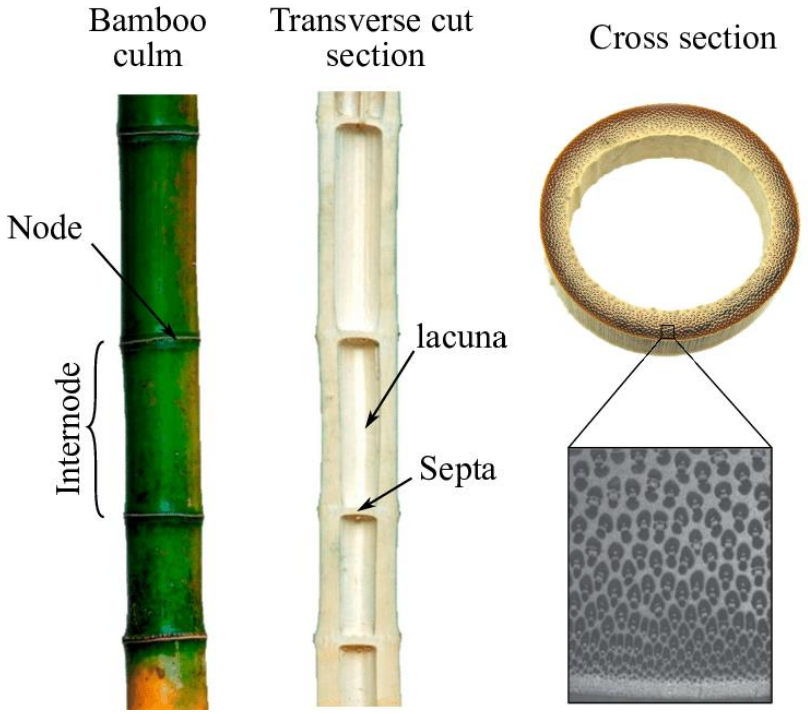
There are cellulose fibers in the longitudinal direction, which is **strong and stiff** and in the transverse direction there is lignin, which is **soft and brittle.**

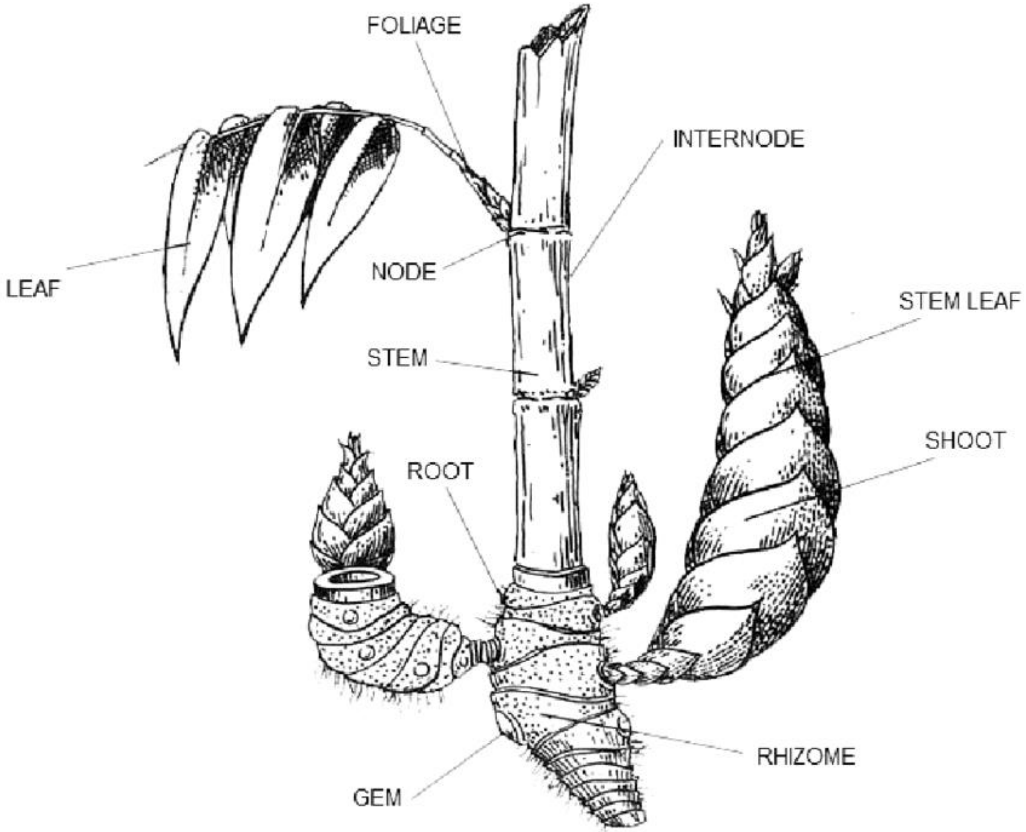
Shrinkage

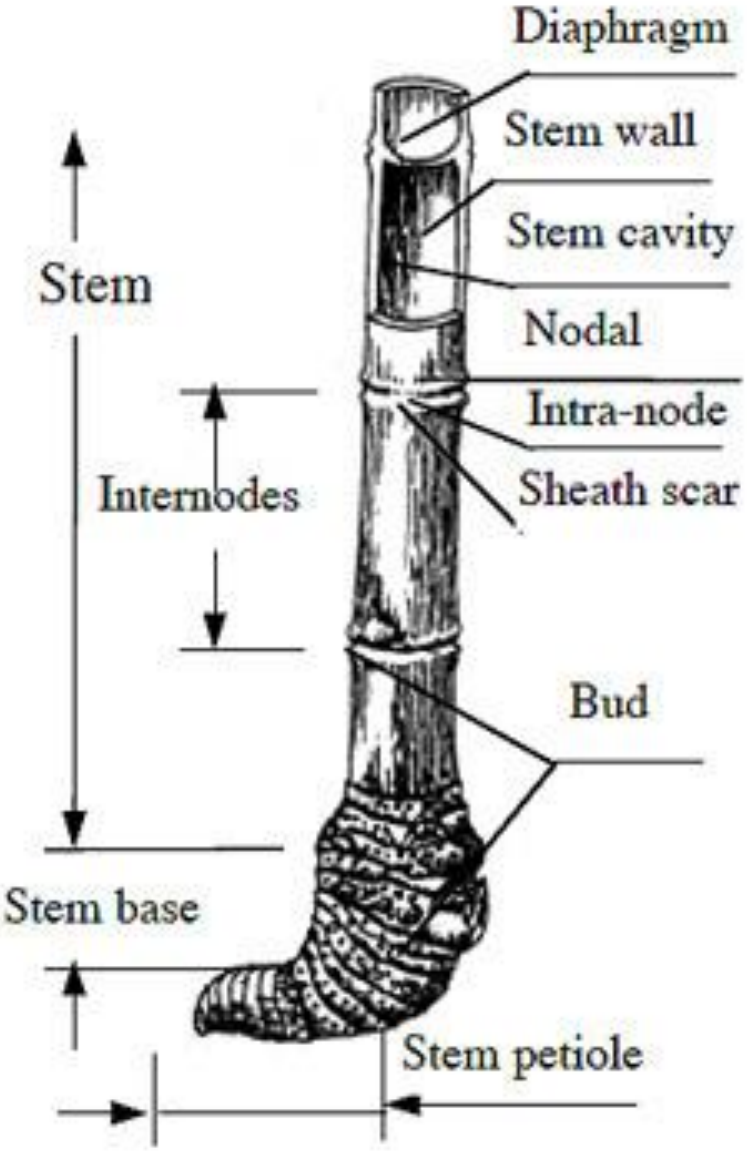
- **shrinks more than wood** when it loses water
- it is necessary to take necessary measures to prevent water loss when used as a building material.

Fire Resistance

fire resistance is **very good**
Filled up with water, it can stand a temperature of **400° C** while the water cooks inside.




FOLIAGE
INTERNODE
LEAF
NODE
STEM LEAF
STEM
SHOOT
ROOT
RHIZOME
GEM


Diaphragm
Stem wall
Stem cavity
Stem
Nodal
Intra-node
Internodes
Sheath scar
Bud
Stem base
Stem petiole

Advantage	Disadvantage
• It is Light, strong and versatile. • It is Environment friendly. • Easily Accessible to the poor. Self renewing resource of nature. • Speedily growing • Highly productive. • Low Cost Material	• It requires preservation. • Shaped by nature • Durability- bamboo is subjected insects; for this reason, untreated viewed as temporary with an than 5 years. • structural efficiency is low. • Lack of design guidance and codes. • Prone to catch fire very fast

- **Guadua angustifolia** (**Guadua** Bamboo)
  and **Phyllostachys edulis (Moso Bamboo)** are undoubtedly the best bamboo species for construction and industrial use, especially in regards to strength and size

In Bangladesh several species of bamboo are prized for their strength and cultivated in villages. These include

- **jai (bambusa vulgaris)**
- **barua (bambusa balcooa)**
- **mittinga (bambusa jaintiana)**
- Naturally occurring bamboos are dominated by the **muli (melocanna baccifera)** variety that grows all over Bangladesh.

(Source: https://www.thedailystar.net/bamboo-60337)

Image: Gadua bamboo

Guadua poles average diameter and wall thickness (103.7 mm and 12 mm, respectively)

moso (101.7 mm and 10.9 mm, respectively)

culm of the **muli bamboo** reaches 10 to 20 metres in height and the diameter ranges from 1.7 to 7.5 cm depending on the age

- The plant is prone to attack by insects and can degrade in the presence of water.
- Long-term durability and shrinkage are also factors to consider.

Thank You