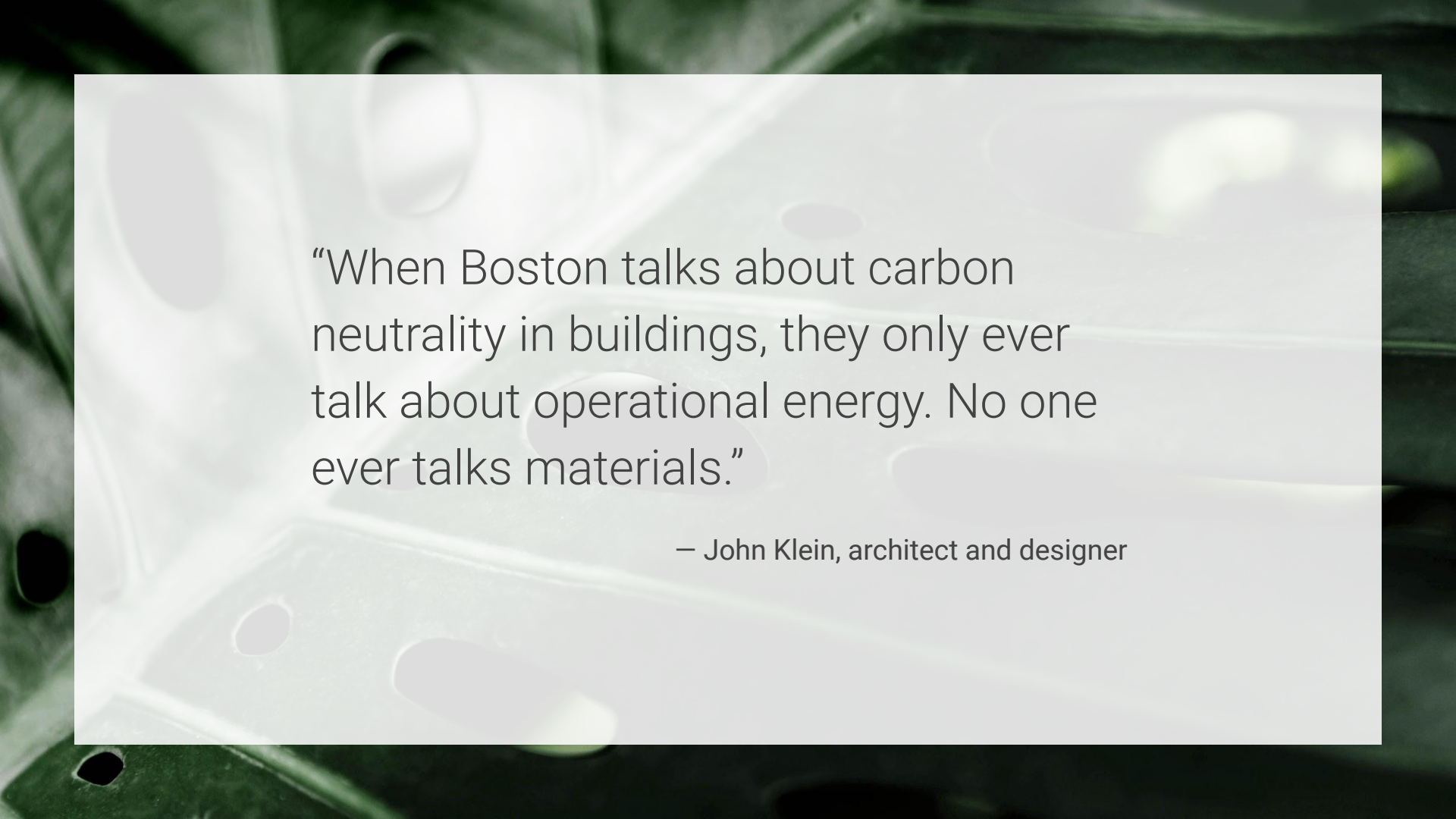
Wooden skyscrapers could be the future for cities



“When Boston talks about carbon neutrality in buildings, they only ever talk about operational energy. No one ever talks materials.”

— John Klein, architect and designer

WOODEN SKYSCRAPERS COULD BE THE FUTURE FOR CITIES

Cities are fast becoming the main abode for people around the world. Urbanisation is a key element that is fuelling growth and creating environments for innovation. That said, cities are made with vast quantities of steel and concrete, which are not environmentally friendly. What if a new resource could be used to create these urban jungles - wood. It is strong and sustainable and so makes a good alternative to traditional materials. Whatever the benefits are, it is an untested material and the immediate benefits could be misleading. Sustainable forestry will need water and land will be covered in a monoculture of trees, hardly an environmentally-friendly solution.

This lesson explores the complexity of moving towards a sustainable construction material.

Discussion Questions

Because key words are great for catching your audience's attention

Discussion Questions

Q1.

What ways can you think of that can improve the environmental friendliness of a building?

Q2.

Of all materials used in a typical building, what will last the longest before needing to be replaced?

Q3.

Do you feel that your city is built using sustainable materials? Can you name any buildings that are?

Q4.

Between wood and steel, what material can be recycled almost entirely?

Q5.

What three things can be improved to the building you are in right now to improve its sustainability for the long-term?

Discussion Questions

Q6.

Environmentally speaking, how much carbon goes up in producing 1 tonne of steel and how much carbon is absorbed by 1 cubic metre of pine?

You can use external resources to help you discuss this question.

Q7.

Chile has 1.3 million hectares of radiata pine plantations, out of an approximate world total of 3.7 million hectares, which represents 35%. Then, how is it possible that Santiago ranks as one of the most polluted cities in the world frequently confronting air-quality alerts and pollution emergencies?

Q8.

If all buildings are made from wood, usually pine, it would mean that large parts of the countryside will be planted by a monoculture of trees.

Does this sound like a sustainable solution?

Article

Because key words are great for catching your audience's attention

Wooden Skyscrapers could be the future for cities 1/4

Wood is, undoubtedly, the most prevalent construction material for building houses. Wood is an organic, hygroscopic and anisotropic material. Its aesthetic, electrical, acoustic, thermal, mechanical and working properties make it very suitable to use, as it is possible to build a comfortable house using only wooden products. Wooden buildings are becoming increasingly taller and more extensive due to the possibilities inherent in the original raw material.

Key benefits of wood include that it is reasonably lightweight and, unlike steel, it is easy to cut. Particularly, cross-laminated timber (CLT) is easy to process and very stable across dimensions. CLT panels can prefabricated and then transported on to the building site. This means that rooms and semi-finished sections can be pieced together at the construction site, and so speed up building time.

Wooden Skyscrapers could be the future for cities 2/4

But wood has some disadvantages too. The drawbacks of wood construction include susceptibility to fire, water damage, decay, and termites. Concrete and steel structure can last up to 100 years given the right care. Some experts say that wood is also a less environmentally sustainable choice than green building materials, such as composite lumber or recycled steel.

Despite its shortcomings, several wooden skyscraper designs have been designed and built. The tallest is now the 18-story wooden dormitory Brock Commons at the University of British Columbia in Canada. Also, the “Trätoppen”, a 40-story residential building, has been proposed by architect Anders Berensson, to be built in Stockholm, Sweden

Wooden Skyscrapers could be the future for cities 3/4

Wooden skyscrapers are considered to be a quarter of the weight of an equivalent reinforced-concrete structure. And they also reduce the building carbon footprint by 60 to 75%. The tallest ever-built wooden non-building structure was the tower of Muhlacker radio transmitter in Germany (190 metres). By 2024, Japan's Sumitomo Group hopes to use CLT to build a 70-storey wood skyscraper in Tokyo, the world's riskiest city when it comes to earthquakes

The benefits of using wood, however, could be negated without proper forestry management. Years of intense wildfire and insect blight have constrained timber supplies, said John Innes dean of forestry at the University of British Columbia in Vancouver, prompting foresters to ask for regulatory exceptions to harvesting limits. That could harm Canada's sustainable forestry reputation.

Wooden Skyscrapers could be the future for cities 4/4

“The truth is, there is no such thing as sustainable building. Everything we do in building includes taking a cost out of something,” said Michael Green, a Vancouver-based architect. Sustainable management will likely increase costs for forestry companies, builders and taxpayers, but for many in British Columbia, home to giants both past and future, those are costs worth paying.

Reading Task

Because key words are great for catching your audience's attention

Reading Task Questions

1. Wood is used more in the construction of skyscrapers and not houses because it is stronger. True / False / Not Given
2. CLT panels are too large and heavy to be transported when used in prefabricated components. True / False / Not Given
3. Sumitomo Group, a Japanese company, were the first to invent technology to build wooden skyscrapers. True / False / Not Given
4. Using wood in building construction will mean forest sustainability will be more difficult to manage. True / False / Not Given
5. Forest fires and insect blight can damage buildings made of wood. True / False / Not Given
6. Using timber in building construction increases the carbon footprint by 60 to 70%. True / False / Not Given
7. Architect Anders Berensson designed and built the first wooden structure in Sweden. True / False / Not Given
8. Concrete and steel structure can last up to 100 years given the right care. True / False / Not Given

Reading Task Questions - ANSWERS

1. Wood is used more in the construction of skyscrapers and not houses because it is stronger. — True / False / Not Given
2. CLT panels are too large and heavy to be transported when used in prefabricated components. — True / False / Not Given
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7. Architect Anders Berensson designed and built the first wooden structure in Sweden. — True / False / Not Given
8. Concrete and steel structure can last up to 100 years given the right care. — True / False / Not Given

Word Choice

Because key words are great for catching your audience's attention

Word choice questions

Q1. Key benefits of wood _____ that it is reasonably lightweight and, unlike steel, it is easy to cut.

include / including / included

Q2. The drawbacks of wood construction include _____ to fire, water damage, decay, and termites

susceptibility / suspect / susceptible

Q3. Wooden skyscrapers are considered to be a quarter of the weight of an _____ reinforced-concrete structure.

equivalent / equally / equal



Word choice questions

Q4. The benefits of using wood, however, _____ negated without proper forestry management.

might be / could be / must be

Q5. Years of _____ wildfire and insect blight have constrained timber supplies

intensifying / intensely / intense

Q6. Sustainable _____ will likely increase costs for forestry companies, builders and taxpayers

manager / management / managing



Word choice questions

Q7. The tallest ever-built wooden non-building structure _____ the tower of Muhlacker radio transmitter in Germany (190 metres)

is / was / is going to be

Q8. Despite its shortcomings, several wooden skyscraper designs have been _____ and built.

design / designing / designed

Q9. Wooden buildings are _____ increasingly taller and more extensive due to the possibilities inherent in the original raw material.

become / being / becoming

Word Matching

A. Steel

B. Concrete

C. Skyscraper

D. Timber

E. Cross-laminated timber

F. Layer

G. Kindling

H. Mould

I. Sustainable

J. Footprint

K. Panels

1. A very tall building of many stories. ***Skyscraper***
2. A hard, strong, grey or bluish-grey alloy of iron with carbon and usually other elements, used extensively as a structural and fabricating material. ***Steel***
3. A wood panel product made from gluing layers of solid-sawn lumber together. ***Cross Laminated Timber***
4. Easily combustible; small sticks or twigs used for starting a fire. ***Kindling***
5. A sheet, quantity, or thickness of material, typically one of several, covering a surface or body. ***Layer***
6. The impact on the environment of human activity in terms of pollution, damage to ecosystems, and the depletion of natural resources. ***Footprint***

A. Steel

B. Concrete

C. Skyscraper

D. Timber

E. Cross-laminated timber

F. Layer

G. Kindling

H. Mould

I. Sustainable

J. Footprint

K. Panels

7. Conserving an ecological balance by avoiding depletion of natural resources. ***Sustainable***

8. A heavy, rough building material made from a mixture of broken stone or gravel, sand, cement, and water, that can be spread or poured into moulds and that forms a stone like mass on hardening. ***Concrete***

9. Form (an object with a particular shape) out of easily manipulated material. ***Mould***

10. A flat or curved component, typically rectangular, that forms or is set into the surface of a door, wall, or ceiling. ***Panel***

11. Wood prepared for use in building and carpentry. ***Timber***

Video Comprehension

Video comprehension questions

1. What is High Rise's perspective on steel and concrete?
2. What is wood's major drawback?
3. When did the era of steelmaking commence?
4. Who is Michael Ramage?
5. Why are some architects proposing a return to wood?
6. What happens as trees grow?
7. What does a study say about using wood to construct a 125-skyscraper?
8. What is CLT?
9. What is CLT about?
10. But how does CLT cope when burnt with a high heat source?
11. Who is Andrew Waugh?
12. What has been Waugh's experience with CLT?

Video Link: https://youtu.be/2DPp2NcnTb0
Mirror: https://www.esldebates.com/wooden-skyscrapers-could-be-the-future-for-cities/

Video comprehension questions - Answers

1. High Rise's view is that all buildings should be made of timber; they think that we should be looking at concrete and steel like we look at petrol and diesel.

2. Throughout history, buildings have been made of wood but it has one major drawback. It acts as kindling. Fire has destroyed large swathes of some of the world's great cities.

3. By the early 20th century, the era of modern steel making had arrived. Steel was strong could be moulded into any shape and used to reinforce concrete.

4. He works at the Centre for Natural Material Innovation at the Cambridge University.

5. Concrete and steel are costly to produce and are heavy to transport. Wood, however, can be grown sustainably and it is lighter than concrete

6. As trees grow, they absorb carbon dioxide from the air, locking it into the timber.

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Video comprehension questions - Answers

7. One study showed that using wood to construct a 125-metre skyscraper could reduce the building's carbon footprint by up to 75 per cent.

8. It is the short for cross-laminated timber. Regular timber is not malleable like steel or concrete and isn't strong enough to build high. But engineers have come up with the solution: CLT.

9. It is basically a new material, even though the underlying material is something we have used for millennia. It is cross-laminated so the layers of wood are glued at 90 degrees to each other, and that makes for a very stable material. CLT is light and it is comparable in strength to concrete and steel.

10. When you remove the source of flame, the fire extinguishers itself. When steel gets hot, it gets a bit softer. Some steel roofs have collapsed in fires where wooden roofs have not.

11. He is Co-founder of Waugh Thistleton Architects.

12. Cross-laminated is a material that he works with a lot. Once the CLT panels arrive on site with, they build a floor a week, at least. This is incredibly fast; this is, maybe, twice asn fast as concrete.

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Debate pros and cons

Benefits of wooden construction

1. Speed of construction. Timber frames are usually built in a matter of days and the frame can be erected before any damage from weather can occur.

2. More flexible design. Timber frames can be crafted into almost any shape and are perfect for an open plan style construction.

3. Green and eco-friendly. Most forested trees are re-planted after they are felled and this makes them a good green option. Wood is a perfect renewable resource providing a perfect eco-friendly construction-building solution.

4. Can be built in freezing temperatures. Timber frame constructions can be built regardless of temperature. This is probably why wood constructions are used in colder parts of the world. In Scotland, for instance, over 70% of today's new builds are timber-framed.

5. One company can do it all. As a general rule, one company can handle the entire construction building process, so construction is a lot simpler and quicker.

Benefits of wooden construction

6. Building time. Because of the time it takes to build walls, plaster them, throw the concrete floors, and dry properly, brick and block frame buildings take longer to construct than timber frame buildings.

7. Thermal Properties. Many materials change in size and volume as the temperature changes. They expand with increasing of the temperature. Wood does not practically expand against heat. On the contrary, by the effect of heat, it dries out and gains strength.

8. Electrical Properties. Static electricity that is dangerous for human health is not observed in wood unlike metal, plastic and other materials. For this reason wood is preferred as a healthy material.

9. Aesthetic Properties. Wood is a decorative material; it is possible to find different wooden materials according to color and design preference.

Drawbacks of wooden construction

1. Fire. A timber frame building does not withstand the heat and flames in the same way a brick and mortar construction would. A timber-framed building can be treated with fire retardants, but this merely slows the surface spread of flames and reduces the production of smoke.

2. Energy efficiency and sound-proofing. Timber frame buildings are not as energy efficient as masonry buildings because they are packed with insulation. As far as sound-proofing goes, timber does not block out sounds as a solid brick construction does.

3. Damp conditions. Damp problems can occur when a timber frame building has been poorly built in an area where wet conditions dominate. A timber frame building will eventually rot if exposed to constant or long-term dampness wood.

Drawbacks of wooden construction

4. Condensation. If condensation builds up in a timber construction, it can cause damp problems that could ultimately rot the wooden skeleton of the building.

5. Shrinkage and Swelling. Wood is a hygroscopic material. This means that it will adsorb surrounding condensable vapors and lose moisture to air below the fiber saturation point.

6. Deterioration of Wood. Biotic (biological) and abiotic (non-biological) are the agents causing the deterioration and destruction of wood. Biotic agents include decay and mold fungi, bacteria and insects. Abiotic agents include sun, wind, water, certain chemicals and fire. a

Debate topics

Wood's renewability makes it an eco-friendly construction choice. Timber construction contributes to lowering environmental pollution.

Steel is one of the easiest materials to re-purpose; it is considered as the most recycled material in the world. There is no need to use wooden CLT in buildings

Timber construction is not eco-friendly. Being renewable is not the same thing as being sustainable.