Is there a role for concrete in sustainable construction?
Sustainable construction practices are increasingly important as Europe seeks to reduce its carbon footprint and boost the circularity of its economy, putting concrete into the spotlight of industry and policymakers.

Concrete, a material commonly used in construction, is facing scrutiny for its high carbon emissions, but the industry is working on developing new, more sustainable concrete options that use recycled materials and emit less carbon.

Experts predict that concrete will continue to play a significant role in construction in the coming years but will need to be produced and used in more environmentally conscious ways.
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There is a role for concrete in sustainable construction; and for mineral products, timber, steel, etc. 6
Europe's efforts to adopt its construction and building sector and bring it more in line with climate and circular economy ambitions will entail a significant change in methodology instead of just using different materials than today.

Europe's construction sector economy comes in at an annual turnover of almost €1 billion, but this comes at a price: Half of EU primary material use is done by the sector, and one-third of total waste comes out. Experts say this must change for the sector to become future-proof.

"The way we build absolutely has to change because we cannot continue to build for the landfill," said Katharina Blümke, researcher at the Chair of Sustainable Construction at the KIT in Karlsruhe.

Because of the way construction works, added Elena Boerman, a fellow researcher on sustainable construction in Karlsruhe, "we have a building industry in which resources are brought in that end up coming out in the form of waste".

Brussels is increasingly pushing to boost the circularity of the bloc's economy, reducing waste and boosting Europe's sustainability.

"We will no longer be able to afford to waste so many resources," noted Blümke, adding that materials like zinc and copper are becoming scarce. And the "planetary boundaries" are also "felt in sand mining." Sand is a crucial ingredient in concrete production, among other things.
The fact that resources go from construction to landfill calls for a new approach to the subject, she said.

“Use other, single-variety materials, choose construction methods in such a way that materials and components can be connected to each other in a degradable way.”

Much like Lego bricks, the world-famous Danish “toy,” the two experts argue, buildings should not be the end of a material’s life in the value chain.

“We have to look at buildings as material stores,” said Boerman. If you have “a building life of X years,” then material would be “stored” in the building. “After that, you can take it out again. Just like a bank. This is how circular building works,” the German expert explained.

**New material revolution?**

Traditional ideas of sustainable construction, a switch to materials that grow back like wood, appear increasingly outdated.

“Building with wood is one possibility, but it is not the panacea,” said Blümke. According to the expert, wood is deemed as a high-value material that should be used as efficiently as possible given its important role in other sectors.

“We can’t just say we’ll build everything in wood, and then we’ll have solved all the problems,” she added. Particularly careful consideration should be given to the use of wood in composite boards – chip boards commonly found in many European households today.

Once a traditional chipboard is created, wood and glue are inseparably mixed in the production process. The biomass is then lost as a material and will ultimately be landfilled, as glues tend to make it too toxic for use as fertiliser.

The two experts are especially interested in the potential of bio-based insulation materials.

“Seaweed insulation has similar U-values as wood insulation, but firstly it is pure, and secondly it can be easily applied. Its natural texture makes it unattractive to pests,” says Blümke.

Given the host of options growing out in the wild, “it doesn't make sense to settle on a single insulation material,” explained Boerman.

“There is a huge variety of ecologically based insulation materials that are recyclable” with similar insulation efficacy as traditional insulation materials, she added. “These would be flax, hemp, jute, and reed.”

The uptake of the new materials has been slow, though.

“There is a huge variety of ecological insulation materials and yet the application rate in Germany is less than 10 percent,” according to Boerman.

Introducing new materials to the industry would not spell the end of legacy products, though, she stressed. “One material is not enough. We need a variety. Materials must be used in specific places where they make sense,” Boerman noted.

“We will never be able to do without concrete, at least as things stand today. But concrete must become cycle-friendly. So we need real concrete recycling, where aggregates and all other ingredients come out again at the end and then new concrete can be made from the same material.”

“Then it also makes sense to use the concrete in certain sensible places in building construction and civil engineering and to take it out of the building stock again,” Boerman said.
Which material will become Europe’s future construction mainstay?

By Nikolaus J. Kurmayer | EURACTIV.com

The European Union’s construction industry stands at a crossroads: In its transition to a climate-neutral ecosystem, the incumbent industry is worried that organic replacements are given disproportionate support.

Construction is a big business. According to European Commission data, the sector employs around 25 million people and generates an added value of €1,158 billion per year.

On the flip side, construction is responsible for 50% of material use and about 35% of waste and emits about one-third of the EU’s total CO2 – both during construction and when the buildings are lived in.

Tackling this two-sided construction and buildings challenge is very much on the mind of Brussels policymakers.

In March, the Commission presented its “transition pathway for the construction ecosystem,” laying the foundation for the sector’s eventual digital and green transformation. The Brussels push is accompanied by initiatives like the New European Bauhaus.

No one knows what this transformed sector, future houses, will look like. Some experts say houses will become Lego-like material repositories, and traditional environmentalists eye a future where wood plays a bigger role.

The prospect of being replaced by wood-based materials has the

Such products make up about 5% of the worldwide total greenhouse gas emissions, more than double that of the global container fleet of 6,000 huge ships, the backbone of international trade.

Today, cement is said to be the second most-often consumed product, beaten only by water.

But production of cement is damaging to the climate as it is ultimately dusted limestone and clay heated to temperatures as high as 1450 °C.

Generating that heat to force carbon out of the raw materials produces extra carbon, while also deeply altering their chemical bonds, creating “clinker”.

The changes leave clinker extremely ready to form strong structures when mixed right, forming concrete with widespread application in construction.

Can timber fix the issue?

Could wood and other bio-based materials help fix the sector’s climate issues?

The EU-supported Intelligent Cities Challenge initiative aims to spread best building practices across the EU, one example being Amsterdam’s local mandate that all new housing projects must contain 20% timber.

Similarly, an ongoing development study, aimed at “outlining how all building-related emissions can be mitigated by 2050” and funded by the European Commission, eyes “full timber structures in new construction” and other roles for timber.

However, to counter the common narrative that “an increased use of biobased products is the simple solution, a short-cut route for transforming the construction sector”, six EU industry associations commissioned a separate study.

The study is supported by Cerame-Unie, the voice of the European ceramic industry, and various concrete associations gathered in Concrete Europe, as well as the European mortar industry organisation and the European brick lobby ECSPA.

Its broad meta-analysis found that “the use of forest products in construction has a discernible abatement potential in climate change mitigation”, but added that the perceptible impact of this is “relatively limited”.

The study similarly questioned another benefit of wood-based construction often touted by its proponents, namely its ability to act as secure carbon storage.

“In order to have any benefits from temporary carbon storage in timber, carbon neutrality through sustainable forestry and parallel active reforestation are unequivocal prerequisites,” the study found. These are currently not a consistent given.

Their findings are supported by nature advocates, who commonly decry the unsustainable nature of logging activities. Green lawmakers blame forestry-oriented EU countries for blocking reform to boost the sustainability of logging.

Katharina Blümke, a sustainable construction researcher at the Karlsruhe Institute for Technology, said that “building with wood is one possibility, but it is not the panacea. We can’t just say we’ll build everything in wood, and then we’ll have solved all the problems”.

Blümke’s fellow researcher Elena Boerman added: “We will never be able to do without concrete, at least as things stand today.”

One way to boost concrete’s green credentials is through “real concrete recycling”, Boerman highlighted but added it was a challenging process largely deemed unfit for real-world application.

The cement industry instead touts carbonation – a process whereby concrete sucks up carbon from the air – as a climate upside. According to the Cerame-Unie-backed study, “cement materials absorb up to 300 to 800 million tonnes of CO2 per year [globally]”.

However, betting on carbonation would be an about-turn for the cement sector.

“The industry has spent decades trying to reduce it because it generally degrades the concrete,” said Robbie Andrew, a senior scientist at the CICERO Center for international climate research.

As lobbying Brussels gets in full swing, a final ruling on what materials will go into future construction products still appears quite out of reach.
We often say “It depends” when we are expected to answer with “yes or no” to a complex question. As with the majority of the choices in life, there is not a “one-fits-all” miracle solution. The same choice might be acceptable in a given context and completely wrong in another: boundary conditions, indirect effects and many other parameters need to be taken into account to provide a meaningful answer.

Construction work (building or infrastructure) is a complex “product”, where the assembly of and interaction between the different components plays a major role. When focusing on the building envelope (or building fabric), architects and designers have a variety of choices to make. Some products or materials have lower emissions at manufacturing but might consume more energy during the use phase and emit even more at end-of-life. Other products may have good performance but need the use of glue or other substances within their manufacture or installation with other products, which hamper their potential re-use or recycling at the end of life. All of them need energy for harvesting or extraction, processing and transportation operations.

Ultimately, only a full assessment of the direct and indirect impact of the whole construction process during its entire life (using a scientific-based method called Life Cycle Assessment – LCA) can help in evaluating the best solution. This solution strongly depends on the expected performance of the structure as well as local conditions, which finally means each project needs to be assessed individually.

Mineral-based construction products (clay, calcium silicate, mortar, autoclaved-aerated and normal concrete) are increasingly confronted with the political promotion of substitution on the belief that the latter is “greener”
and more sustainable. This is linked with an over-simplified feeling that bio-sourced is a-priori superior and that carbon emissions are the only environmental impact that matters. Confronted with this situation, natural questions arise: is this a correct assumption? But can we really have a one-size-fits-all solution? What is the scientific background behind it? With these questions in mind, European representatives of the above-mentioned sectors commissioned a study to LBP | Sight and Royal HaskoningDHV (peer reviewed by Norsus) to try and assess the sensibility and fairness of the substitution approach.

The study “Carbon Accounting for Building Materials” (CA4BM) concludes that yes, wood can contribute to reducing carbon emissions in the built environment. This however holds true only in very specific cases, where a full set of conditions is satisfied: no deforestation, the carbon neutrality of managed forests, the processing at end-of-life of a wood product and the consideration of the usually long transportation distances. To achieve the objectives of decarbonisation set out in the Green Deal, the study concluded that there is a need for all construction materials to decarbonise: not only because we need all of them for an effective built environment, but also because all of them require operations which emit carbon in different phases of the building life.

“One material is not enough. We need a variety. Materials must be used in specific places where they make sense,” another expert says. It will be the ability of the respective industries to innovate in response to the societal challenges that will determine the future use of construction products in a sustainable way.

“Our industries need to provide an answer to the climate change challenge, which we are all collectively engaged with; but we should not forget that resource use, biodiversity and water are of the same order of importance”, Alessio Rimoldi, Secretary General of BIBM and project manager of the CA4BM study says. “A building does not only need to be low carbon: it needs to persist and keep its function for as long as possible, provide thermal and acoustic comfort to occupants, a healthy indoor environment and protect people from accidental impacts, like fire or extreme weather events”. Primary and secondary (coming from recycling activities) raw materials for mineral products are locally available, which guarantees short transportation distances and supply chain security.

The study also pointed out the need to have a scientific approach to the assessment of CO2 emissions and to base the results on sound assumptions. Due to the fact that the science behind climate change is newer compared to more established branches (structural safety, thermal behaviour etc...), it is still possible to twist the results by changing the starting point and the assumptions on future developments. Within the CA4BM project, a literature review of studies which conclude that construction with wood is (generally) more sustainable, shows that “All studies assumed carbon emissions from conventional materials to be static, whilst assuming emissions from forest products will decline in the future due to production scale-up and innovation”.

“On the one hand, we are concerned about a decline in the world’s forest areas because of its detrimental effects on climate and other environmental aspects, while on the other hand, an increased use of wood in construction is being promoted as a contribution to climate change mitigation. How can both arguments be valid? If using more wood than we currently do was more sustainable, wouldn’t we first need to grow the extra wood before harvesting it?” says Antonio Caballero Gonzalez, Secretary General of EMO and ECSPA.

European policies should tackle societal challenges by providing the enabling framework: setting the objectives and ensuring fair methodologies to assess their performance. Then, space should be left for actors in the market to have the freedom to innovate and provide solutions that are technically sound and sustainable. Additionally, policy makers should encourage and support all sectors in their decarbonisation path, concentrating on the most emitting phases of each solution.

The CA4BM Project Partners

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