

Structural stone - a sustainable alternative

The use of stone as a structural material has fallen so far out of favour in most of the world that its properties are no longer even taught in architectural and structural engineering degrees in the UK, and there are few building standards to cover its use.

The idea has been circulating for a while that stone should reclaim its place as a sustainable structural building material. France has been at the forefront of this, and has been using stone as a load bearing or semi-load bearing material since the end of WW2. As a result, although they still lack a building standard for the use of stone as a principle building material, most French quarries issue strength certificates for the stone that they produce.

In the UK Amina Taha's Groupwork architectural practice has been working closely with Steve Webb of Webb Yates and Pierre Badaud from the Stonemasonry Company Ltd to champion the use of stone as a loadbearing material and in February 2020, the Building Centre played host to an exhibition entitled "The New Stone Age", curated by the three men.

The madness of modern building techniques

Especially when the quarry is close to the building site, the use of stone blocks to construct a building can be more environmentally-friendly than brick or wood. Stone does not need covering or coating to make it weatherproof, and although wood is lighter to transport and captures a lot of CO₂ during its growth, it needs more processing than stone, and once the building reaches end of life, it will be left to rot, or burnt which releases that CO₂ into the atmosphere.



Carrara Quarry In Italy



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The Inventory of Embodied Carbon and Energy 2019 gives “general stone”’s carbon footprint as 0.079kg/kg compared to 0.15kg/kg for concrete and 2.8kg/kg for steel.

The production of concrete involves quarrying rock, grinding it up to make gravel, quarrying limestone, transporting it to factories and processing it to make cement, digging up sharp sand, then mixing them all with water to make liquid cement, and transporting it all to the building site. We need to prepare the site, using wood and timber to support and form the concrete whilst it sets and waiting till it is dry enough to carry on with the site. At the end of all this we have a stone-like material that is approximately 20% of the strength of the original stone (40N vs 230N), needing steel to strengthen it. And in many cases we then cover it with a façade of stone.

Another area where stone wins is that nothing is lost in production - even small offcuts are still of use as ballast or hardcore, and at the end of the building’s life 95% of it will simply be removed and reused rather than going to landfill.

The fact that stone has a high level of thermal inertia gives it very good insulating properties, making it easier to regulate the internal temperature.

It is of course a finite resource, but even if we started using it for all of the world’s construction, it would take many millennia for all of the stone in the world to be used up.



A self-supporting stone arch in St Michael's Church, Birmingham



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Construction possibilities

The French architect, Fernand Pouillon, who was active after WW2, used stone blocks pre-cut to set dimensions for large scale projects such as one of 5000 dwellings in the Ile-de-France. These buildings became the model for future development, and architects are now experimenting with the use of stone blocks as a replacement for concrete block, sometimes in conjunction with concrete to reinforce the structure, where large openings are required.

Tahia and Webb advocate the use of stone pillars to replace concrete, and in the Building Centre exhibition demonstrate that it is perfectly possible, and environmentally more friendly to create a 30-storey tower from stone with 12m² open plan stone floors made from blocks threaded together with cables. 15 Clerkenwell Close is proof that stone can be used in a modern idiom and does not just lend itself to a more historical context.

However even where a whole building is not going to be in stone, it is still possible to add in elements such as staircases, arches, columns that put the strength, longevity and environmental credentials of stone to good use.

Now that a climate emergency has officially been declared, surely there has never been a better time to reconsider the use of stone in construction?



Marble staircases in Burberry Regent St



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