



Architecture: Stone Lego-blocks for climate control

(August 2009) The fact that Italy's President gave participants at the G8-Summit, held in L'Aquila this July, [books with marble covers](#), may have been an unwittingly symbolic gesture. The participating Heads of State agreed a limit on global warming. It might have been appropriate to include representatives of Italy's stone industry in the discussion.

In order to achieve the global climate goals set at the Summit, CO₂-emission must be drastically curtailed. This is where natural stone can play a major role. Carbon dioxide ensues with construction and living.

Natural stone scores top marks in durability: production releases almost no emissions at all because the stone is already present, unlike cement with must be produced in huge ovens; even could be used second quality material from the quarries; and stone's potential for storing energy is impressive so it can even serve as a natural form of air conditioning.

Also stone can be recycled almost endlessly.

And this is the salient point: construction using massive stone requires a fresh approach. In the short term contracts will probably be limited to niches initially interesting mainly for ecologically committed landlords as can be seen in France. France is the leading country for massive stone construction.

Proponents after WW2 were, among others, Paul Marcerou, quarry owner and gifted tinker in stone saws, and the architect Fernand Pouillon. They perfected the concept of pre-cut stones or pierres prétaillées. These stone blocks in a few standard-sizes leave the quarry ready to build and need only be stacked one above the other at the construction site ([video](#)).

Several thousand homes were built



Gilles Perraudin's Wine cellar in massive stone for the Solan Monastery in southern France.



Quick and easy building with massive stone blocks. Photos: S. Demailly

according to this Lego-block principle, e.g. the famous Aix-en-Provence settlement. Pouillon erected the outer walls of 80 cm x 40 cm blocks several stories high. The inner construction is made of reinforced concrete.

Today the Architect Gilles Perraudin is one of the leading builders in massive stone - building, as did his forerunners, with the Lego-block system. His wine stock built for the Solan Monastery by Avignon drew considerable attention. The standard blocks used here are 210 cm x 105 cm x 52 cm - simply because this is the standard-size produced in the nearby quarry.

Stone was the material of choice because the cloister community is keenly interested in ecological correctness. The members of the Holy Order wanted to make sure that the building material used would not taint the wine with any sort of emission over the years.

Energy conservation is another important issue for the members of the cloister. To ensure a constant temperature Perraudin was asked to construct the walls of massive stone: stone absorbs the cool night climate and slowly dissipates it during the daytime when outside temperatures rise considerably. The humidity of the surrounding air is also absorbed and aids the stone to cool off as the condensation evaporates.

Construction time was exceedingly short: one month only. „Using blocks as big as these, we were able to complete 2 m² a day“ according to Perraudin. The blocks are stacked one on top of the other without cement or binding elements and held in place by



Detail in the settlement in Aix-en-Provence.



A massive stone house in the famous Pouillon settlement in Aix-en-Provence. Photos: Stefano Zerbi

their sheer mass. The lime mortar merely prevents the wind blowing through the joints. Mixed with stone sawdust from the quarry the colour blends in with the stone perfectly.

In colder climatic zones, stone can conserve energy too. Stefano Zerbi of the University of Lausanne is currently writing his doctoral thesis on the subject. He expounds that stone cores in the buildings' interior could help store heat. The warming rays of the sun radiate heat through a glass front on the south side of the building, „the north side would be insulated, of course“ comments Zerbi.

Building with stone also has its down sides. One clear disadvantage is the thickness of the walls which reduces living area.

Stone is only expensive at first glance. Of course it would be possible to use less expensive, lower quality, building materials for massive construction. „A stone block that is not suitable for use as stone slabs because of clay streaking is still perfectly suited for building massive walls“, says Zerbi. "

Also, no grout finishing is needed. And last but not least: because of its longevity, the stone block could be recycled when the building is set to be torn down.

That would require radical rethinking: thinking of demolishing a building before it is constructed. This is, however, normal procedure in many areas today: many household appliances are already being built with a view to dismantling them in their

product groups.

This, of course, sheds a different light on long-term investments which can be recuperated in the wreckage phase.

Albeit the stone blocks must be undamaged for maximum value. Where then, to mount pipes and wiring? Back in the fifties, Fernand Pouillon integrated them in the inner concrete walls. Today, Gilles Perraudin proceeds boldly referring to such famous buildings as the Centre Pompidou in Paris where pipes and wiring are mounted on the walls. He challenges architects to find „new innovative ideas“ for installation.

Zerbi also refuses to prise open the stone blocks. „Wiring has a lifetime of a couple of decades, stone has a lifespan of hundreds of years“, says he.

Transportation is expensive, however. So stone should be acquired locally. This is exactly what conservationists are preaching: less transportation amounts to less CO₂ -emission.

Experience shows that all types of stone are suitable for massive construction. In Spain and Portugal the massive stone used for construction is sometimes granite according to Gilles Perraudin. Stefano Zerbi is looking at local gneiss.

Just as important as the economic and technical aspect is, what do architects and contractors think of the Lego-block construction?

Zerbi has made a computer model of a gneiss facade showing possible



Lego-block façades with two standardized stone-formats. Computer model: Stefano Zerbi



surface design. The theme really fires Perraudin up. „This brings architects back to their roots“, instead of losing themselves in the detail of modern gimmikry and newfangled material.

LINKS:

Gilles Perraudin ([French](#))

Stefano Zerbi ([Mail](#))

The comprehensive history of massive building construction in stone in France is published in [Pierre Actual](#) (10/2007).

More examples:

Calder Ingenierie ([French](#))

[Stone Museum](#), Japan, by Kengo Kuma (2000)

Villas Vanille, Montpellier: Dividers in massive stone between houses ([pdf](#) [French](#))

Stone façades by Eric Perry Architects, London ([pdf](#), [pdf](#))