2008-6

Frame it - Thoughts on Education, Reducing Carbon and Vapour

Joseph Little
Technological University Dublin, joseph.little@tudublin.ie

Robbie Cousins

Recommended Citation

Cousins, R. (2008) Frame it - Thoughts on Education, Reducing Carbon and Vapour,*Frame It' magazine, June 2008*

Building Life Consultancy

A SERVICE OF

Joseph Little Architects

Thoughts on Education

Reducing Carbon and Vapour

PUBLISHED IN 'FRAME IT' MAGAZINE, JUNE 2008

By
Robbie Cousins

Against the grain

Joseph Little believes timber frame can be the backbone of a new generation of low-carbon, energy-efficient housing, and be used as an intelligent response to Climate Change and fuel prices. But he tells Robbie Cousins that timber frame manufacturers, suppliers and architects need to gear-up and work more closely together if the true potential of this vision is to be realised.

Joseph Little's chief bugbear is poor construction standards & details on site and the core of this issue is how the knowledge set of architects and builders and how standards are controlled. The seeds of this idea may have been sown when he was an architecture student at UCD in the early '90s. It was clear to him as a student that the way architecture was taught in this country was outdated with insufficient emphasis on construction quality and the Environment.

"In my first three years studying architecture in UCD the Energy Research Group (ERG), which had offices in the top floor of the School of Architecture, had published an excellent book on environmental design, various papers, had advised the Government and created the 'Thermie' exhibition that toured Europe. At the same time the teaching we had on environmental science/design was limited and very out-dated. It was clear to me even then that this was a great missed opportunity. I discussed it with other students and when I became auditor of the Arch Soc I used my position to meet with the faculty authorities. I requested stronger links to the ERG and emphasised the value of their knowledge to students. The meeting went well, I thought. But in the end access was never received, the ERG remained off-bounds and the teaching of environmental science/design remained archaic for several more years.

Joseph Little is very passionate about his architecture. His designs combine aesthetic with practicality and he places the principal of environmental sustainability at the centre of his work. He says: "this society is faced with resource depletion, fuel poverty, health problems and climate change. Architects and builders have a great responsibility, but also a tremendous opportunity to deal with these: every building we make can use significantly more renewable and lower impact resources than presently, can be a nurturing, healthy place to be, can insulate its owner against increasing energy costs and even help to sequester carbon at source. We should recognise that builders and architects are 'at the coal face' in facing these issues: a change in our approach can have a powerful impact!"

Sacred Heart School

In 2000 as project architect (for Oppermann Associates) on the Sacred Heart National School, Huntstown, he implemented a number of passive solar features that were unusual for that time. The brief called for the extension of an existing one-storey 16-classroom school by a further 16 classrooms, large hall and ancillary accommodation. His initial studies led him to reject the site selected for the expansion. Instead he proposed and assisted a land swap with the local parish for land on the other side of the school lands which had been earmarked for the parish church. Joseph says: "My studies showed that the new site would result in a more compact design, shorter corridors and importantly a roadside presence for the school: so important in suburban areas where there are fewer civic buildings and miles of mundane housing estates. For the same reason I made sure that the building itself, not its carpark, came up to the street edge".

He continues: "The conventional approach to the brief on this flat site would have been to build the Extension on the same level as the existing building, with dark corridors deep in the plan surrounded by classrooms that get there light from windows in the outer walls or in internal courtyards. I made twosignificant changes to this. Firstly I proposed that spoil from site excavations could raise the whole front of the Extension by 600mm, secondly that a two-storey atrium be created at the centre of the Extension where an internal courtyard would otherwise have been needed.

Internally this resulted in a higher corridor wrapping the lower atrium creating an implied 'stage and'audience'. Externally there was also the practical advantage of giving the front classrooms and their gardens a higher elevation: for sunlight, views, privacy and security. A ten year old standing in the garden can look horizontally straight over the garden wall, oblivious to an adult walking along the pavement just outside.

"With regard the atrium we argued in the funding submission to the Department (a) that the social benefit for the school was huge and (b) that the extra cost of roofing the atrium was minmised because the cost of the external ground floor walls of a courtyard (that would have required otherwise) had been shifted upwards to pay for the first floor walls of the atrium: the argument worked! The two-storey library, the headmasters office, the staffroom, the GP hall and a few classrooms cluster around the atrium a few metres from the main entrance.

Joseph also innovated in the design for ventilation: "We used 'Windcatcher' balanced flue ventilators: great cowls that project from the roofs of the front ten classrooms and the atrium. They take in the cleanest, most sound-damped air possible by being located at the back of the classes (or atrium) at high level. In Winter the vents' dampers can open at five in the morning for a half hour then shut. This ensures that all the stale air is quickly replaced, heat loss is minimised and the new body of oxygen-rich air has a few hours togradually warm using the building's fabric, before solar gain and any heating comes on and the children arrive. It's a simple system by the standards of heat recovery ventilation units available today but it is virtually free to run, relying as it does on air pressure, has few moving parts and is very robust."

The headmaster, John Lynch, who's in contact with many other headmasters has told him numerous other architects have followed his lead and made similar innovative applications to the Department. In 2003, with a growing commitment to, and better understanding of, energy-efficient architecture Joseph established his own practice, Joseph Little Architects. Not one to do things by half he also started an MSc in 'Architecture: Advanced Environmental and Energy Studies' (with the University of East London) at the Centre for Alternative Technology, Wales at the same time. Joseph is currently at sketch design stage on a forty-class, three-storey, national school using some of the same principles. His goal is to lock carbon into its walls with hemp-lime timber frame and for the whole building to be as close to 'Passive House' standard as possible.

Reducing carbon

Having worked with different building forms, Joseph Little has come to the conclusion that timber frame could be the build method best suited for a new generation of energy-efficient buildings. He says: "Timber, used well, has the greatest potential of all structural materials to create carbon neutral architecture and its tectonic and thermal characteristics provide endless potential for engineering energy efficient structures."

I ask him has he used concrete. "Of course I have. The slabs in my current projects are concrete (albeit with a cement content of 70% GGBS). On a recent extension project we calculated that 8.5 tons of CO2 were displaced by using GGBS instead of a more conventional cement mix. GGBS is a by-product of steel production and has already paid its carbon penalty."

He goes on, "Concrete's a wonderful product. It has great creative potential and is likely irreplaceable in certain niche markets, however as an industry and society we use it indiscriminately. Extract of virgin aggregate is one problem but the carbon impact of extracting, processing and transporting cement is the big issue. In November 2006 the International Energy Agency published a report on energy efficiency and CO2 emission reduction potentials in the worldwide cement industry, arising form a commitment made at the Gleneagles G8 conference. The report estimated that in 2005 0.83 tons of CO2 were emitted (directly and indirectly) from the extraction and production of every ton of cement. Furthermore cement production amounts to almost 8% of the world's total global CO2 emissions (~28.75 billion tons of CO2).

"As reducing carbon becomes a greater and greater necessity for all members in society it seems irresponsible to me as an architect not to try to reduce or eliminate elements of a specification that contribute so much to global warming. For that reason we have set ourselves the challenge of finding ways of designing-out or at least reducing our use of cement in all our building projects over the next few years. Mass housing, particularly with timber frame, should be one of the easier places to start, given that it is generally low-rise and has low structural loads.

What excites Joseph most is the idea of a timber frame building rising from a sound structural floor of little or no concrete, where the timber frame is encased in a hemp-lime biocomposite. "Imagine a housing estate, a town centre, a school where every part of the building has been designed to be not only practical and elegant but also carbon neutral, and where certain elements, like the walls and roof, are actually sequestering carbon. A situation where the construction of our new developments more than offsets the carbon they would otherwise release! It's not just a powerful idea; we're starting to do it."

Specification in timber frame

While giving timber frame the thumbs up Joseph has a number of issues with the open panel system most commonly used in Ireland. His main assertion is that alongside insulation and structural requirements the buildup must deal with interstitial water vapour. As you move from the inside of a completed open-panel stud wall the level of vapour permeability should increase. He explains: "You have a temperature gradient from a warm room inside to the cold outside. As air cools its ability to carry moisture lessens. If vapour condenses at a point where it can't evaporate back into the room later or continue out through the structure mould growth and structural decay will occur. Neil May of NBT wrote eloquently about this. A pdf on the subject can be downloaded from www.josephlittlearchitects.com."

He continues: "If you install an OSB3 board with too much glue on the outside of the frame this is exactly what can happen. I've heard it said that the original reason the board was placed on the outside was as a protective measure against the blockie and the usual outer leaf! Certainly throughout most of mainland Europe where block or brick cladding is less usual the sheathing board goes on the inside. We have used 'Panelvent' on the outside on one recent project and used an inverted buildup in another. Panel Agency Ltd state that 'Panelvent' is 5.8 times more permeable than 'Sterling' OSB3 board and ~11 times more permeable than most other boards, but no less strong. The project with inverted buildup had tight curved walls: two sheets of over-lapping ply: taping their junctions and the slab above and below provided the airtightness line. Insulation was placed in the services zone on the room side and also between the studs outside. Beyond was a breather membrane, a vented cavity and an untreated cedar rainscreen. We had both projects checked for u-values, dew point and vapour permeability in all conditions: both came out with flying colours.

Joseph says it is essential to assess the vapour permeability of whatever sheathing board is being used. "Every supplier should be able to provide full details of their boards. Neil May quotes the resistivity of OSB boards as ranging from 100 - 300MNs/gm. When you consider that a sheet of plywood could have a resistivity as high as 6000MNs/gm you can see how

inappropriate specification could be very serious. At the other end of the scale Panel Agency Ltd quotes an amazing 1.47MNs/gm for their product 'Panelvent'. The architects or timber frame specifier needs to look for and be focused on these figures just as much as U-values or racking strength. It is no longer good enough for us to leave the specification to someone else: the impact of too impermeable a board (on the outside) is too great".

Moving forward

Joseph believes that the potential of Irish timber frame design is vast. He says there is now a great opportunity to innovate with the product in Ireland. "When Irish architects as a whole start to design for timber instead of adapting other design forms to timber frame, the outcomes will be very exciting. But architects, timber frame manufacturers and material suppliers also need to gear-up on specification, for example designing for healthy vapour movement and the imperative of reducing, and whenever possible sequestering, carbon.

The other great challenge is to see how we can make greater structural use of Irish lumber, make Irish OSB boards with lower resistivity values etc, and become the major suppliers to our own burgeoning timber frame industry. In the coming age, where transport will become ever more expensive and the carbon impact ever more significant, supplying locally may not just be sensible, it could be critical."