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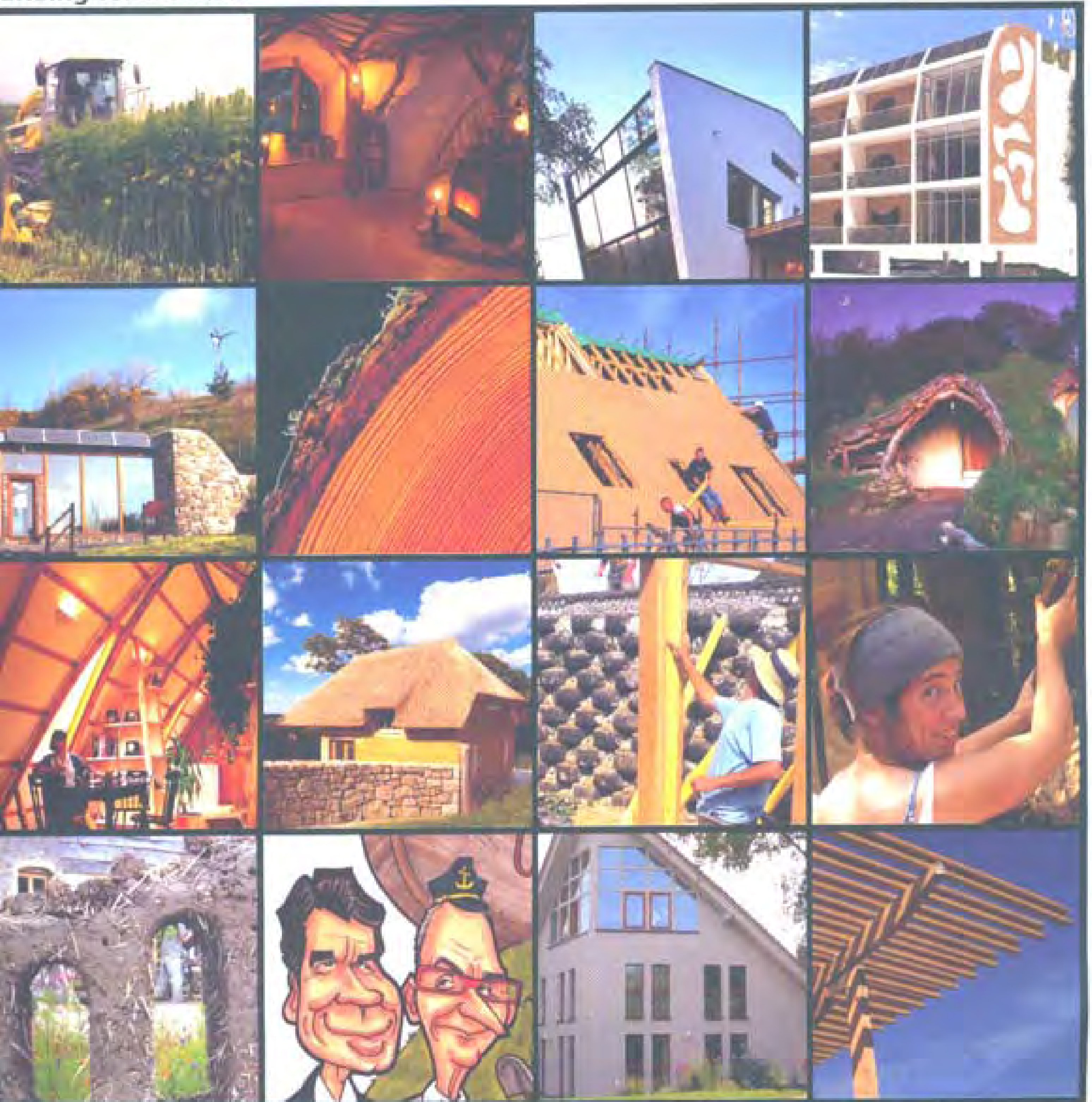


MAIN FEATURE
Building Elements - Walls

GREEN RUSH
Green building organisations under the spotlight

ZERO CARBON
Is it just a big RED herring?

SCOTTISH TIMBERBUILD
Part 3 - The return of the forests

Eco-Pads - old tyres for new rotating mansion

Rural property surveyors, Fischer German, have successfully helped to secure planning permission for a massive recycled car tyre walled home that actually rotates with the passing sun. The inventor and the designer believe it may provide the ultimate in green living by maximising the use of reclaimed, natural and renewable resources.

A concept rotating home is all set to be built in rural Derbyshire. It is the brainchild of engineer and inventor Robin Hamilton. One of the key aims of the project is to apparently produce an environmentally sensitive building that is still contemporary, yet has a 'wow' factor and costs less to build than comparable designs. This will be achieved through a combination of innovative design, new building techniques and the use of redundant or recycled materials. Other aims of the project are to enable buildings of this design to be constructed without the need for expensive equipment or specialist trades. It will be very well insulated to minimise energy consumption. The recycled tyre wall is an integral part of this concept.

"This dramatic and contemporary concept is certainly unique and is sympathetic to its natural surroundings and terrain," says Kay Davies from Fisher German's planning

SOUTH WEST ELEVATION

Feedback from the forum

We asked users at www.greenbuildingforum.co.uk what they thought of very large houses being called green buildings. We cited this project as an example.Should a home have a maximum floor area to rightly call itself green? Should the Code for Sustainable Homes (and other standards) address this issue?

Ecowarrior was first to reply and said: "Wow this house is huge, is he opening a hotel? For a home to be sustainable there should be a maximum floor area - number of people in the household ratio. As one of the major problems with the lack of housing at the moment is due to the dramatic rise in households since the end of the first world war (single person occupancy a main culprit). If we are to have sustainable housing this factor cannot be ignored."

Chris Wardle said: "What grates with me is that you can build in the countryside if you can afford to put up a half million pound mansion of 'outstanding architectural quality' but you can't buy a 20 acre small holding, with a genuine intent to farm it, and build yourself a low impact cottage. That's one rule for the rich, another for the rest of us isn't it?"

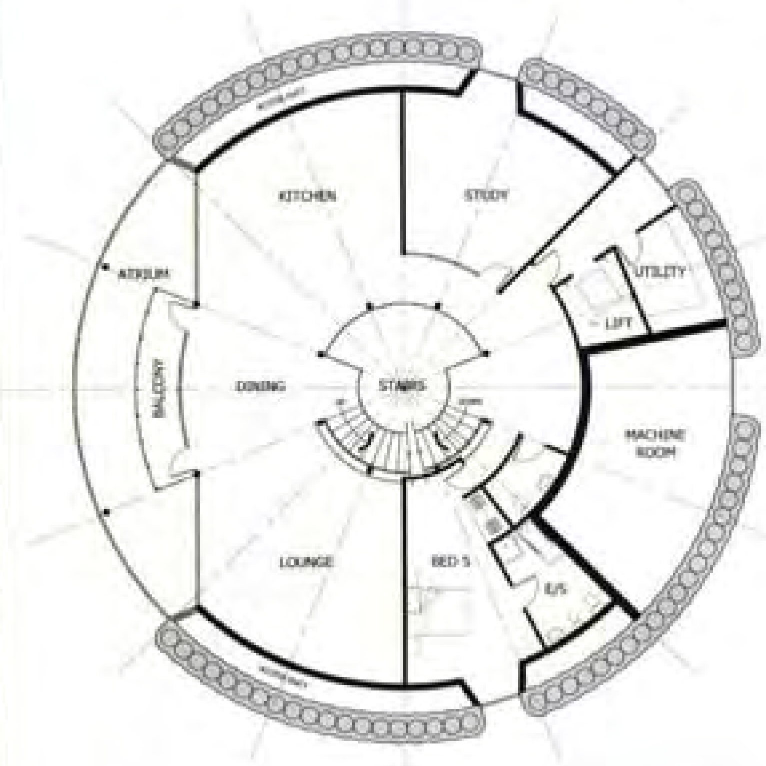
Liz M answered one of the initial questions: "The Code does have a credit relating to ratio of footprint area to total area. Perhaps the next revision could have a credit of area per occupant. It could also mean that the tiny flats that you get in cities could also be penalised for being too small. I've lived in a really tiny flat in the past with my husband and hated it. It felt like living in a hallway and understair cupboard, it was that small."

ADs added: "If there were to be a minimum/maximum area per occupant, who decides how many people actually occupy a house? Generally speaking we don't just buy houses for us and our immediate family to live in - we often have 'spare' rooms for visitors (or offices, or junk rooms, or...). And would gardens or other outdoor space have to come into the calculation? Many (most?) '3 bedroom' houses are more like 2 bedroom houses with a small additional room which may be 'ideal for use as an office'. Inevitably, therefore, people buy houses that are theoretically bigger than they need, but actually meet their requirements".

Paul Teather added: "For a more stringent definition of an 'eco-home' we need to move away from performance based targets to impact based assessments. New homes should have a design allowance of CO_2, e.g. kg per person. This would mean that a large home has to be more efficient than a small home; the council deciding on the total allowance and also rateable value (linking the two, the latter being almost inveitable as it is an easy tax to justify). There could be some tweaking with upper limits; but fundamentaly the principle should be equality. If somebody wants a larger home then they can pay to reduce its impact... This should also include the impact of the building itself. The average UK home is responsible for 50 tonnes of CO_2 in its construction; so we have the situation now where Bedzed type constructions (700kg CO_2/m^2 construction cost) will be favoured over straw bale homes (carbon storage walls!). So, if you want a mansion, build it out of straw bales and fill the estate with biomass and wind turbines.

Have your say: www.greenbuildingforum.co.uk

Ian Bevan RIBA



and development team. "Throughout the planning process, we've received very favourable responses from everyone involved, including the local planning authority, Derbyshire Dales District Council. We believe this to be the first application under Planning Policy Statement 7 not to be called in to inquiry by the Secretary of State."

Commenting on the approval, Hamilton said, "I'm really looking forward to starting work on this dream home. I've been developing the concept for many years and I am delighted that planning permission has been granted. This property will certainly boast some rather distinctive features, not least the fact that I hope it will become the most energy efficient, cost-effective 'green' design in the UK. Its features can then be applied to other domestic and commercial buildings."

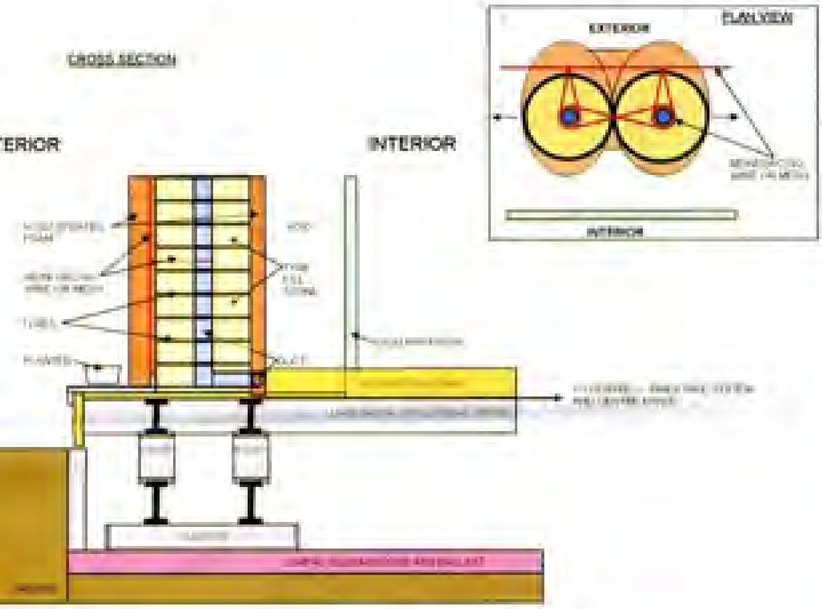
Hamilton is no stranger to reclaimed materials. His previous business was closely involved with waste and recycling machinery and the general handling and processing of materials. He, like many others, appreciates that the disposal of used vehicle tyres has long presented major problems. This new build project sets out to find a useful role for old tyres (not dissimilar to earthship pioneers), trying to utilise the characteristics that normally make them so difficult to dispose of, but in a positive way. This project will use about 10,000 tyres, so if the design was used in other buildings, the mountains of waste tyres that exist will soon be converted into beneficial products in helping the construction and the transport industries in their goals to reduce waste and energy consumption. With buildings being a major user of energy, improvements in the insulative properties of walls, by using reclaimed tyres, could play a valuable role.

Walls as the lungs of the building

The walls of the home will be built up in vertical columns of tyres, with each column containing a large bore air duct. The columns are tied together in a similar way to conventional cavity walls with wall ties and will be erected in increments of about one metre at a time, with an aggregate slurry poured into the void spaces to completely fill space between the inner tyre walls and the air duct (Fig. 1 on next page). The aggregate slurry will be vibrated down to form a dense solid stone core, providing the rigidity of the wall.

Another innovation will also feature on this particular building - it will revolve! More on this later, but the revolvability of the building will actually help to reduce the scaffolding requirements of the construction. Scaffolding access will only be built around a small arc of the building. The first segment of the wall will be built and then the whole building rotated round ready for the next segment to be built.

Hamilton says that the tyre walls in this project will be inherently stable as the walls are curved – the whole building is round and the diameter of the building is 24 metres. The exterior walls will be between 650mm and 1m thick. Tyres come in many varying diameters so, during construction, the outer face of the tyre walls will be kept at an almost constant diameter through placement of the tyre against a former (carried by scaffolding), resulting in a more variable inner diameter. This does not matter as a service corridor 1 metre wide runs right around the inside diameter of the wall, with a conventional studded and



1. *Cross section and plan section through the lower section of external wall and service corridor.* **© Robin Hamilton**

plasterboard inner wall separating the exterior wall from the internal living space (see above). This inner wall will be insulated as for the outer wall.

The service corridor will allow easy access around the building (a bit like an old secret corridor). This is where services such as electrical and plumbing will be routed and positioned wherever they are required. This will also allow for easily change or upgrade of services in the future.

When completed, the exterior walls will be sprayed with a rigid setting foam, thicker on the outer face. This completely seals the tyres, provides a more uniform external surface, and further increases their insulation value. The total 'R' value of the completed wall is predicted to be 13.23, providing a U-value of only 0.08. The total insulation value of the entire wall section, including the service duct and inner wall will be even better. To finish, the outer surface of the tyre walls will be protected by a UV coating.

As already proven in earthships, tyre walls provide very high thermal mass, and can be thought of as a very large conventional storage heater/radiator. This is where the air ducts come into play. These air ducts pass through each tyre wall column and are interlinked, thus allowing air to be blown through them to extract latent heat captured and stored within the walls during the winter, and for this air to be cooled during the summer. This air will be handled through a machine room, where it is distributed through the remainder of the building, as required, for heating or cooling. The damping effect of the high thermal mass is estimated to provide a virtually constant interior temperature. The whole building has been designed to be airtight with a low positive internal pressure.

The 'tyre walls' being so thick, with a solid stone core, provide a very large load bearing surface area in plan view. A wall plate/beam is fitted at the top to spread the loads, and in this project not only is the roof completely supported by the walls, but the first and second floors are then suspended from the roof.

This project is certainly a first, and is adopting a combination of design and build techniques that have not been used in such a combination before. The process of gaining planning approval and showing compliance with building regulations involved appraisals from several other organisations, and raised several queries and eyebrows, but all were satisfactorily resolved.

Tyres, and the foam coating, are flammable and special consideration has been given to this, including special coatings and a fire suppression system within the service corridor. Sprayed foam coatings are energy intensive in their formulation, but on this project it has been accepted that the energy savings that the design of this project provides over the ensuing years will easily offset this. The required new embodied energy in the construction of the overall 'tyre wall' is exceptionally low when compared to conventional building techniques. The tyres, which would have been scrap and a disposal liability, are being reused, and the crushed stone is similarly low on the energy required to process it.

It is accepted that this tyre wall design is part experimental, and different construction and filling techniques may be tried initially before the bulk of the walling continues. Some fine tuning of the concept is expected and allowed for, and the goal of a highly insulated wall, with controllable and useable high thermal storage/mass, largely built from waste tyres and local aggregates, should set a valuable example that others can follow. The experience gained and results will all be made available when the project is completed, and advice then offered to others who may wish to adopt similar techniques.

Thanks to Fischer German for providing the background