

Episode 22

Why Build a House with Straw Bales?

The show notes: www.houseplanninghelp.com/22

Ben: Mark Saich from Green Building Solutions is my guest as we look at straw bale building.

Maybe we could start with an overview of your career in sustainable building?

Mark: Well I've been in construction for about 25 years as a carpenter, joiner, building control, environmental health and my interest in construction and concern about the way we were building, about waste, about embodied energy with the materials we use etc., led me to explore the use of various other materials. Straw bale building, I stumbled across on the Internet and that really caught my interest; this was around 2000, I suppose.

From then I've been looking into more and more, and over the years I've got involved in projects. Now for several years I've been assisting other people to build and running training courses.

Ben: When I first found out about straw bale building there was a part of me that thought oh 'this is a bit weird'. Is it something that has been around a long time?

Mark: Yeah it's been around since late eighteen hundreds early nineteen hundreds in Nebraska in the US and early settlers built houses using straw bales because there weren't many other materials around at the time.

Ben: If we are starting out what do we need to know about straw bale building?

Mark: There are a few issues you need to consider, one is the quality of the bales although they are essentially regular bales that you would see in a farmer's field the ones that you build with do need to be good quality so they need to be nice and tight, they need to be reasonably even sized and just general good quality, dry, vermin and seed free etc. that kind of thing.

Ben: How do you know that it is good quality? If I were looking at it compared to you, you would know what you are looking for; tell me what do I need to see?

Mark: Well if a bale is damp it will smell damp, it will probably look damp as well, it will be darker it might even be blackening; it will be much heavier than a usual bale. Obviously you kind of need experience of a dry bale to know whether you are holding a heavy bale, but a degree of common senses and asking sensible questions of the farmer or engaging the services of someone who is experienced in straw bale construction.

Ben: So when we put down the foundations presumably that's just standard is it and at what stage do we start building with bales?

Mark: Well I suppose we should take a step back here really because there are two main types of straw bale construction. One is called a load bearing and this is essentially when you build out of bales just as you would if you were building with bricks. So those would normally be built on a plinth wall on a strip foundation. Now you may be able to build a low impact foundation with less concrete but really this comes down to the ground conditions and the size and design of your building but there is potential for that. So a strip foundation, probably a cavity wall up to about six or eight inches above ground level which is about the usual place of a damp proof course in a normal masonry or indeed a timber framed house. And then from there you build what we call a ladder which is in timber framing talk is a soleplate and that is fixed to the plinth wall and then you stack the bales in what we call a running course which is like bricks.

Ben: There is definitely something in me which is concerned about moisture getting into the bales so maybe we could look at that. There are enough straw bale buildings around that obviously it is not a problem, but how do you protect it against moisture, you are saying first of all that there is a damp proof course at the bottom which is fair enough but have there been cases where the moisture has got in?

Mark: I am sure there are buildings which haven't been detailed or haven't been built properly and have suffered. Over the years I have had people come back to me and talk about having mushrooms growing and black mould on their unfinished build but the problems weren't inherent with building with straw, it was their inappropriate detailing and temporary weather protection during the build. So the sources of moisture for a straw bale building or any building, in fact, it is an

important thing to think about. A lot of the rules and things we need to address in a straw bale building are actually the same issues whether you build it of brick, block, timber, rammed earth or cheese, it's the same principles. Get it off the ground and stop rising damp coming up into the building and that's where you have your damp proof course. Essentially in a straw bale building the damp proof course is protecting the timber ladder as much as anything. The other source of moisture is rain and we keep rain off buildings by having either impermeable or semi-impermeable materials, so in a brick house it is the bricks and mortar that do it, in a timber frame house it is often timber cladding, shiplap cladding, that kind of thing or render and in straw you can use the timber cladding or the render so that the lime based render will hold the rain off but what it will also do is allow any moisture that's built up in the wall to, well basically, sweat out. The other source of moisture in a building is everything that we breathe out, the moisture from cooking, from drying clothes and that's got to go somewhere so we deal with that in buildings through ventilation so opening windows, sometimes the trickle vents in windows, mechanical extract fans or whole house ventilation systems. Another technique not used instead of but to assist in that whole process, is to use materials which we call breathable and by the term breathable what we actually mean is the ability of materials to take up and release moisture without adversely affecting the longevity of those materials. So materials like timber, sheep's wool, wood fibre, wood, lime plaster and straw bales are all what we call breathable materials and therefore can take up some moisture and allow it to migrate to the outside or to re-evaporate back into the building without causing rot of the structure.

Ben: When we are dealing with these very natural products how good is a straw bale, for example, as an insulator because we are very interested in the energy efficiency at the end of this so it's not just that we are using natural low embodied energy materials but also the other side, can you have both I suppose?

Mark: The energy in use, absolutely. Straw bales are excellent insulators, it depends on the type of straw, the density of the straw and the quality of the build but as an average you can assume straw bales will have what's called a U value of 0.15 watts per metre squared. So that's the rate of heat loss for every square metre of wall. Now to put that in context if you build an extension under the current Part L then the heat loss in your wall should be no worse than 0.28 watts per metre squared, so roughly a straw bale wall has half the heat loss of a building regs compliant wall. As another example, to put it in context, if you are designing to the Passivhaus standard

which are buildings that need very little heat input to maintain a level of thermal comfort, the starting point for U values of walls floors and roofs is 0.15 so you can see it is a very energy efficient material.

Ben: When you model with PHPP is there an issue that you don't know that the straw the whole way across is going to be the same u value, that there may be some fluctuation or does that just even out.

Mark: I would say it evens out. I am not actually a Passivhaus consultant I am aware of the standard and the methodology and I know that the certifiers of the Passivhaus standard are much pickier about the U values in construction but that u value of 0.15 I would say is a safe average for the entire wall. There certainly are people claiming it is as good as good as 0.12, I think it's the Balehaus which is the ModCell system I think they claim 0.12. To know exactly you have got to do tests on wall panels of know density and known type of straw which is why I kind of stick with the 0.15 it's safe as if you do a U value calculation on generic values for straw you get a similar U value. When you consider other materials which you know must perform about the same you still end up with a similar U value so it's kind of the value I use to be safe knowing that it is probably better.

Ben: Is there a situation where straw bale is naturally more likely to be chosen or can it be used everywhere so long as you have the space because it's slightly wider isn't it?

Mark: I suppose the main issue, yes, is space. Typically with a rendered and plastered or rendered, plastered and clad wall you are going to have walls that are about 500 millimetres thick, half a metre. A lot of people would think that's rather thick but going to Passivhaus standards and current building regs for new buildings and knowing where the building regs are heading we are going to have walls of at least 400 thick anyway so it's not that much thicker. But yes there will be instances certainly in dense developments in a city where you may not want to sacrifice the space so therefore you may go for a petrochemical insulant to get the performance that you want but, other than that, straw bale walls are used in a whole range of different types of buildings and different sizes of buildings and those who want a natural building with low embodied energy and high energy efficiency are not put off by that extra four inches of wall thickness.

Ben: And there are no constraints in design, you can have anything?

Mark: Pretty much, yes, like with any building there is usually a solution to get something close to what the client wants but there are, as with brickwork as with timberwork, there are rules of thumb that you want to follow so ensuring that you have got a universally distributed load all the way round which means that the roof loads, snow loads, floor loads are distributed across all the walls so you haven't got point loads and therefore differential settlement within the building. Having a decent return on corners, a decent reveal I suppose you would call it, things like that and then, as I said earlier, about being above the damp proof course and having a decent overhang on the roof. They say treat it like a baby keep its bum dry and give it a good wide brim hat and then you should be fine.

Ben: When these building go up, you've mentioned a few times about how to even out the load, but do you have to have some other structure at a point if you wanted to build quite a high building?

Mark: Well actually I suppose this takes us back to a few question ago when you talked about foundations and we talked about a load bearing structure. What I mentioned was the other type of building the non-load bearing which is essentially a framed building with straw bale in between. So taking both of those methods on the load bearing you can do single or double storey and there are some examples of three storey. Often though, the third storey is a kind of half storey so it's got a low eave so it's a bit like in a chalet bungalow or something like that. That reduces some of the risk and some of the heights of the straw but it also makes better use of the materials because you are occupying half a roof space. If you want to go seriously multi-storey if you are going to go beyond that then I would suggest probably a frame is the most appropriate and then infill in panels as you go and then there is no limit. If you have got a frame your engineer has proved will stand up you can go as high as you like, the Empire State Building.

Ben: Do these buildings hold their value or are people sometimes nervous because, oh I prefer something that's got concrete or is built brick and block?

Mark: I'm not sure of the answer to that. Although there are quite a few straw bale buildings in the UK and across the world I don't know how many have actually been re-sold. I would think, I would suggest that particularly on houses, people who have built their own straw bale house have found their dream plot they've built their dream house and they keep with it. But as to value and to be able to sell it one of the concerns obviously is to get a mortgage. Now

generally you should be able to get a mortgage on any building as long as it is structurally sound and if the building you have built has been approved, inspected and signed off by building control you shouldn't have a problem. Some mortgage companies insist on a building warranty particularly for new buildings and you can get building warranties from a number of warranty companies as long as it's been designed, approved and built properly and signed off. Also I think it is Triodos and the Ecology Building Society I believe will both lend you money at a preferential rate if you build to a good eco standard.

Ben: Is it cheaper overall than if we were going to take some other approach? It seems like it should be.

Mark: It certainly has the potential of being cheaper. One of the things about changing any technology or trying to build an eco-house if you bolt on features to try and make it an eco-house or if you just transpose one material for another, then it may cost more to build either in straw or to have eco tech built onto the building. But if you take a step back and design your building from scratch with good environmental considerations and with your chosen material, straw in our case today, then it does have the potential to be cheaper. The things that affect price, the walls, the cost of the walls of the house are only approximately fifteen to twenty per cent of the total build cost, so from that point of view if you just say here are my plans for a brick and block house but I want straw instead of brick and block then the walls might be half the price but it's half of fifteen per cent so it's not going to make a big impact. But if you design the house to use straw and maybe make your own clay plaster, if you use reclaimed materials, if you are doing it DIY, if you build the size to the size you need rather than your greed then it does have the potential to be much cheaper to build. Also, of course, if you have the same thermal performance in your floor and your roof and you have high performance windows pointing to benefit from solar gain etc., if you have high efficiency heating, lighting and hot water systems then you have got the potential of having a cheaper house which will be incredibly cheap to run for the life of that building.

Ben: Is there any other aspect that I haven't brought up that is worth mentioning?

Mark: I suppose one bit of advice that I always give to people is that straw bale definitely lends itself to a diy build, that's without doubt. It's friendly, it's fun, it ticks all the environmental boxes and all of that but what I would suggest is that it ought to be a guided DIY so I would always recommend that you engage the services of

someone who understands how to design buildings with straw and ideally someone with practical experience of doing it. There are lots of little tricks about splitting bales and forming junctions with windows and things like that and, you know, we still want to make sure that it's fireproof and vermin proof and airtight and all of those things and it's easy, if you don't have experience, to race ahead and go, it looks simple, it looks quick, I'll do it and unfortunately you won't get the full potential out of you building both in energy terms and longevity.

Ben: What is the best way to learn about this?

Mark: Well definitely sign up for a workshop from somebody with lots of experience. I run courses in East Kent and there are other very experienced people in other places around the country.

Ben: Well Mark we've had some fantastic information today. Thank you very much.

Mark: Thank you.