

Episode 78

Externally Insulating a Bungalow with Straw Bales

The show notes: www.houseplanninghelp.com/78

Intro: John Butler is my guest and we're looking at his retrofit project. Quite an important aspect of this one, his wife Anna is disabled so they really wanted to make sure that the floor was level throughout the building and that each of the rooms was very easy to access. This had to be a mobility friendly build.

First I asked John what led him to taking on this renovation.

John: I guess the starting point was when I went WWOOFing - Willing Workers On Organic Farms - I think it's now called Worldwide Workers On Organic Farms: staying on organic farms and volunteering in return for board and food. And a couple of those people were talking about straw bale building. It sounded really clever and interesting and that sort of sat in the back of my head for ages and then every now and again I'd hear a bit more, or someone else would tell me.

Fast forward a bit, Anna and me were living in London. We'd been there about 5 years and both independently got to the point of needing to leave. I was brought up not too far from here in Dorset. She was brought up in Suffolk, so both countryside.

And the idea, I think Anna suggested, looking for somewhere where we could build a straw bale house. And we started looking for plots and building plots around here do exist but they're very rare because it's quite densely built up anyway within the town, and in the countryside obviously it's the countryside and then it's very hard to get planning permission. And we were competing with builders. The sort of building plots that we thought you could put a nice bungalow and garden, they'd be squeezing a little terrace of 5 or 6 houses so the prices were way out of our range.

And then, I think I've missed out, I did some straw bale building courses after we moved, while we were looking for plots, with Bee Rowan from then Amazon Nails. She's now Strawbuild, I think. And she showed us some slides of a bungalow in the Czech Republic which had been wrapped on the outside with bales for external insulation and that stuck in my mind and got tucked away

somewhere. And then when we couldn't find a plot it popped back up going well maybe we could do that. Because this town has an awful lot of bungalows and they're all very low levels of insulation, very poor energy efficiency. They're not very energy efficient. So we started looking at bungalows we could potentially extend with bales and wrap with the bales on the outside.

Ben: One question I have and it's more because of where I am at the moment, looking for plots, so I can empathise, but they always talk about find a bungalow and then you can knock it down and start again. So you've said that this area has lots of bungalows, not a good idea?

John: Well a lot of the people, in the early stages we had to do quite a lot of major structural changes to the roof and I used a building company for that and they were all saying, why don't you just knock it down, it will be easier. They may have been right actually, it would have been a lot easier and potentially a lot cheaper but then you've got all that material from the bungalow going into landfill which is really wasteful, and structurally it was a well-built bungalow. There's nothing wrong with it apart from a complete lack of insulation. So it just seemed really wasteful to knock it down.

We did look a bit at Woolaway Bungalows, those concrete slab structures. If we'd found one of them we probably would have knocked it down because there's not a great deal I think you can do to them. So although it's not where we came from to start with, I'm quite pleased we have ended up renovating this place and making use of an existing building and hopefully [it] seems to have worked. We'll find out over the winter but improved its energy efficiency and made it much nicer.

Ben: But you've not just upgraded the original property, you've added to it as well, so yeah a retrofit and addition?

John: Yeah, it's kind of hybrid. In terms of the footprint of the plot we haven't extended much. Where we're sitting now in my office was a garage, and there was a timber rotten shed with windows at the back so we haven't taken much new ground but I think we've made much better use of the space that was there.

Ben: And how did you start then?

John: Again it started really with the straw bale course. I did, one of the straw bale courses I did was run by a guy called Kuba Wihan who is Czech, and it was actually his house in the Czech Republic that

I'd been shown slides of, or his father's house, but he did the externally insulating with bales. So that was a really perfectly timed meeting because he'd actually done it, what we were thinking about doing.

So we stayed in touch and then once buying the bungalow went through he helped us with drawing up the plans and then supported us throughout the whole process over Skype. He did come on site when we were doing the actual bale work and marshalled us and the volunteers to keep on top of it and advise on what to do and how to do it.

Ben: What did you like about straw bales, because you could have come to this plot and thought what am I going to do with this, but clearly that was in your mind at that stage?

John: Yes, straw has been part of the plan all along, whether it was a new build or a retrofit. It sort of just seemed like a fun material to work with on the sort of initial contact with the idea, and then the more I learned about it the more I realised it is a very sustainable material. It's a waste product from agriculture. I think somebody calculated how many houses you could build with just the waste straw and it's in the tens of thousands, if not the hundreds of thousands, but definitely the tens of thousands.

It's very well insulating, well in the whole thickness of the bales you end up with a very well insulated wall. It's breathable and vapour open so you don't have the same issues with condensation that you have in a lot of construction materials. It's very accessible, really easy to use; you don't need to have specialist knowledge of building or previous knowledge of building necessarily to be able to work with bales, especially if you've got the good support that we had.

My experience from doing straw bale courses and volunteering on some bale builds is there's something about working with straw or the people that come to work with straw, maybe a bit of both, that the atmosphere on those building sites is always really, really positive. Really fun, just sort of seems to bring the good side of people out.

Ben: And you mentioned a couple of times about the wrap of straw bales, so what do you need to think about when you use straw bales as external insulation?

John: You've got to make sure there's no gaps between the bales and the original wall for starters, because that would potentially air flows which could bypass your insulation. That's my understanding of it anyway. And also rodents could crawl in. So we've got a brick bungalow which is just pointed, so rather than just clamping the bales against that we levelled the surface with clay plaster so nothing could crawl along the brick pointing channels.

Also, the clay plaster is very good at soaking up excess moisture and then releasing it slowly, so it's good at regulating moisture at the contact between the insulation and the hard bricks.

But the main thing is I think a very firm connection between the bales and your walls so they can't peel off. We used a system devised by Kuba to clamp the bales onto the wall and make sure they're compressed.

We did need to dig new foundations for the bale wall, so for the external insulation we just had to dig down about a foot below the concrete strip which marks the top of the original foundations and we were trying to have concrete free foundations so that was backfilled with layers of chunky gravel. So rather than filling the whole thing and compacting in one go you'd compact it layer by layer to make sure it was very firmly packed basically. And then on top of that to tie it together just a 200mm strip of limecrete which has lower embodied carbon associated with it.

And then with all bales, whether it's load bearing like the extension is here, or for the wrap, you need to keep them ideally off the ground by about a foot. So there's a small plinth brick wall which is itself insulated and well-draining to make sure any moisture that gets in, if anywhere leaks the water will just run straight through the bales and drain out through the foundations. But that keeping it off the ground stops the rain getting into the weak spot - the join between your foundations and the bales basically. Also it gets them out of flood range. We're on a hill so that's not such an issue here but it's always belt and braces!

Ben: That provides the insulation so what do you do about the airtightness?

John: That is one of the things I think that if we did this build now, we'd probably do slightly different. I've learnt so much doing this build that I probably know enough now to do it really well! [John laughs.] Now that we've finished and we're living here! And so the airtightness sort of evolved a bit throughout the build which is

exactly how everyone tells you not to do it, if you want a really airtight house you need to plan it in advance, and we didn't.

Ben: I think what I would find interesting is if you could take us through what you were thinking originally in regards to the airtightness, and then with all the experience that you've built up throughout this process, because I bet someone's about to go through this and they would find that really helpful to see how you addressed it.

John: I think to start with I was only very vaguely aware of the need for airtightness and I started to become more aware quite quickly, but it wasn't planned in from the beginning how we were going to make this place airtight.

Ben: So why, why did you suddenly become aware of airtightness or just spending time with...?

John: Just spending time researching. I'd been reading a lot online and I'd joined Twitter and through that started following various people who've got much more experience of this and much more in depth knowledge. And they shared links to things which got me reading more about airtightness and how important it is for energy efficiency, because if there's a big air gap your heat's just going to go out through it with the air essentially. So yes, I learnt a lot more about that once we'd started which is slightly too late.

But once we started and I realised that we needed to make it airtight, I then tried to find out what I needed to do and how. It did evolve throughout the whole build which is not the best way of going around, it's how everyone tells you not to do it, but what we eventually did was a kind of hybrid of various different ideas.

So the extension does have an airtight membrane fitted above the plasterboard on the ceilings which is taped to the walls at the sides. All around all the windows I've used airtightness tapes and around the doors to try and seal up everywhere where there's a cable entry, that's come through a rubber grommet to make sure there's a really tight seal. Although when we did the air test they were one of the leakiest things, so you can't just use these things without paying really good attention to the detail anyway.

In the old part of the bungalow, again it was airtightness tapes around the windows but half of the ceiling had already gone up before I started really understanding about airtightness. So most of the old part doesn't have an airtightness membrane, it's relying on the plaster skim to keep it airtight, which hopefully it will. You can

get good airtightness from the plaster, provided its joins with the wall are very good, which is probably where we've got one of our weaknesses. And also the original floor slab of the bungalow isn't sealed to the walls for airtightness anywhere. I just missed that bit frankly. So there's probably quite a lot of air leaking.

Ben: And can you address any of these issues now, because that's one of the amazing things about an air test, and finding out where those leaks are?

John: Thankfully we did the air test before completing fitting everything out. We did an initial air test which did highlight a lot of issues. One was the problem with everywhere a cable entered or left the building into the roof it was leaking air. And the extension, that particularly surprised me because I had used the grommets but now I realise... I think some of them I'd put two cables through one opening and that's one of the things they say never do. I now know that. And in the older part the cables come down through ducting. Simple things like sealing the ends of the ducts with silicone we hadn't done but it was still at a stage in the build where we could. I could go round, I had to take some socket fronts off, but that was straight forward, and squirt the goop in there. I think that's probably not the most reliable means of airtightness but it's better than leaving it.

Ben: Let's go back to that situation, you're turning up here for the first time and you now have the knowledge that you do have. What would you do? What would be your approach?

John: I would plan it from the very beginning. I would still need to actually do a lot more research before starting to get a really good airtightness system, especially with the bales and the clay plaster. It's still a slightly evolving thing, how you seal the bales. I think the bales, plastered bales are very airtight. Even the bales themselves if they're densely packed are quite airtight. The problem is joins and I think universally with any kind of construction where one type of material meets another material. So with the bale walls it's where they sit on the plinth walls and where they meet the doors and where they meet the windows.

So planning whatever strategy you're going to use for sealing those joints is really key I think, whether it's embedding tapes into the plaster which then stick to the windows so there's a continuous layer.

One of the problem leaks we had was that joint between the foundations and the bales because I hadn't really thought about it. Again, I thought the compression of the bales would be enough to seal it and of course it leaked quite a lot. But that I was able to use an airtightness tape to wrap around the thing. We hadn't put the finish coat of plaster on yet so there was some room to do that.

Ben: And you can use the airtightness tapes on any different structure, so say for example you've got was it concrete under here, or perhaps not this new bit, and then the plastered walls, so is that where you'd put the tapes?

John: As far as I understand it, yes, there are different tapes and different glues for different materials. I'm not sure how... the materials used in the tapes and how sustainable they are and what impact environmentally there is from them is a whole interesting area that I'd like to look into, and I haven't yet! [Ben laughs.] So there's always that trade-off between something which makes it energy efficient and then whether that material is inherently energy heavy on carbon, and its production. It's a difficult one!

Ben: Yes, and we're going to keep coming back to that one! Okay, let's get off all this airtightness, sorry to take you down that!

Looking at the bungalow then in terms of how you changed the layout. How did you come about with that plan and knowing this extra space that you were adding so that it would suit your lifestyle?

John: I think we started partly with what was there. The original bungalow had certain spaces and then we sat down and wrote down what we needed or what we wanted in addition to that. How much extra space, what for, not in terms of metres squared of extra space but just I wanted an office and a music room. Anna wanted a room she could do her felting and art things in. We wanted to have enough bedrooms that we can have our own bedroom obviously and then guests could come and if we have children then they can have their own bedroom and still have a guest bedroom. So it was what was there, what we wanted extra and how much ground space was available that we could actually build on. So it was trying to draw all of them together.

I did some initial plans using SketchUp 3D design programme and sort of rough mapped out pretty much the floor area, floor plan that we have ended up with. The tricky thing was working out access from the old bit to the new bit from the bungalow into the extension, where to put a corridor without taking up lots of potentially useful

space because corridors are useful, you need to get from part of the house to the other but you don't hang out in them.

So that took a bit of working out and then I sent my rough drawing to Kuba who has been the designer and consultant throughout and he sort of tweaked them, made them actually work, came up with some really good ideas like the vaulted ceiling in the main living area which just gave us one area where there's, you know, really big high ceilings, much more light. Because one of the things we needed to do was bring, was insulate the original floor slab, which obviously means bringing the floor level up a bit. So a little bit closer to the ceilings than we would otherwise have been.

Ben: Ah, so how have you insulated that slab?

John: We've used wood fibre insulation boards on that, because again, very renewable sustainable materials. I think it mostly uses trimmings and factory waste, so it's not virgin trees that have been felled specially for it. The insulation properties are pretty good. It's also another material that regulates moisture, so if you do get some condensation, or some moisture leaking through to the floor slab, it shouldn't condense in fact because it will just be soaked up by the wood fibres.

Ben: And this is on top of it as well? We're not talking about underneath?

John: No, well the other option would have been to dig out the original slab completely and backfill and then we could have had a much greater level of insulation but it comes back to that thing of where do you put that stuff you've dug out? Plus I think if we'd gone to the point of digging out the floor slab it would have made more sense to just knock the whole thing down because trying to excavate within a building without knocking the building down accidentally seems to me a nightmare task! [John laughs.] We weren't going to go there basically! That's one of the reasons this isn't a Passivhaus build because we couldn't get enough insulation into the existing floors without digging them out.

Ben: It's always a challenge, isn't it? And light was something else that I wanted to ask about, because you do have to be careful when you're adding on each different side that you don't block out too much light?

John: Yes. We've tried to bring light in in lots of different ways, particularly with the bathroom, which has stayed in its original place although its configuration is different, which meant that we built an extension

past the original bathroom window so we've got light into that using solar tube reflective light pipe basically.

There's a roof window in the extension outside where the bathroom window sort of still is so that there's borrowed light from there. Basically we've tried to let light come through from as many different places as possible into what would be the darker bits of the building. We've got solar tubes in various places in the extension, again because they let lots of light through but they're very easy to fit and they don't take up much roof space so structurally you don't have to have a big opening like you do with a Velux, although we have some of them.

The problem we found is that we've put in quite a lot of roof lights to get lots of light and in the summer that's led to some overheating because obviously the sun's very high, it beats down directly through all our lovely roof lights and once the heat's in it's in, because it's very well insulated. I think the insulation on its own will never lead to overheating but if you've got that much sunlight streaming in you do get a little bit of overheating.

Ben: Was that a surprise?

John: Slightly. Again, now I wouldn't put in so many roof lights.

Ben: PHPP!

John: Yes, exactly! [Ben laughs.]

Ben: This is really interesting to hear, going through this thought process. I'm sure this is very handy. Now, can you do anything post having this issue? There must be some shading, not that it's going to be easy?

John: We did think it might be an issue in the big open room with the two large roof lights which is the living room and the kitchen combined. And there we did fit external shutters from the beginning and they do work if we close them on a really sunny day in the summer it blocks the light out before it even comes in, which is...

Ben: It's not what you really want to do, is it?

John: Yeah, it's not ideal. It means it's also a bit dark! [John laughs.] But I mean there are, we've got normal windows as well so there is still light coming in and if it's that sunny you're not hanging out so much in the living room anyway. You're either outside or, so it's nice when

it's that hot that you can come into a cooler space. It's a bit like on the continent when you have the shutters on all the windows and the houses are quite dark during the day and it's not as dark in fact.

The other option would be internal blackout blinds which aren't as good. Basically once the sun has come through your glazing you've kind of got it, so putting a blind on the inside can reduce it if, it will turn the window itself into a bit of an oven but will cut down the amount of heat that comes into your house. But obviously it's a blackout blind so it will be completely plunging you into gloom so I'm trying to avoid that! [John laughs.]

But if I'd known what I know now we would have planned this and tried to use the Passive House Planning Package (PHPP) and all those kinds of things and not had overheating as a problem. It's kind of annoying to have overheating as a problem because we were thinking about saving energy and not being cold in the winter, but of course we've gone the other way.

Ben: As we get towards the end I feel I should be asking something more about the physical exertion that you've put in to this. But I don't really know, not being as I say a person who's going to do this myself, whether there's any advice you'd want to give to someone who was going to go down this route of doing a lot of the work themselves?

John: I'm sure everyone says it, but plan for it to take a whole lot longer than you thought it would. It's really satisfying doing it that way, knowing that I've done an awful lot of the work and being able to point at things and go I did that, I plastered that, I built that. It's really satisfying.

It's really draining as well and it takes over your life for that time I think, possibly even if you're not doing it though. I mean just having your own house built, even if you're not physically building it I'm sure will take over. It's all encompassing, put it that way. That's both really good and really difficult all at the same time, depending on your mood really on any given day I guess!

To cut a long story short, make sure you have help or just volunteers or people who are coming in regularly, because if you're working on your own for a long period of time the bits that are good are brilliant, the bits that are harder if you're just there on your own, it's a bit of a struggle. There's no one to poke you and keep you more motivated during the day sort of thing.

A good example of that is the clay plastering on the inside. Clay plastering is inherently a slightly slow process and through being disorganised I hadn't managed to arrange for it to be done as courses or a big bunch of volunteers, which was the original idea. It was never meant to be just me and a bucket of clay.

So the first coats of clay went on forever. I love working with clay, I'm a potter really so working with clay is lovely and I inherently loved every moment of it, but it did start to go on too long. As soon as I decided that I needed help and got two friends and paid them to come and help clay plaster, they'd not done it before, but I could train them up quite quickly, it was transformed into a really enjoyable amazing process because then there was at least 2 of us, usually 3 of us, sometimes 4 working at once. The progress was much faster and that's always good practically and psychologically. So you can do it on your own, but try not to was probably the summary there!

Ben: You've shared lots of insights with us. One further question that I would like to ask is about the finances. So doing this yourself I'm imagining you're going to save quite a bit of money, but in hindsight was there anyone that you could have hired that might have actually saved you money, or in running costs, in the long run?

John: That clay plastering example, if I'd started paying people to help me right at the beginning it would have happened in a much shorter amount of time. It's the time trade-off I think particularly. I wasn't having to pay people to do everything because I was doing it, but it takes an awful lot longer. If I'd paid people it would have happened quicker and potentially you get back to work quicker I guess as well, so it's, yeah.

The whole process is one big balancing act on all kinds of levels and there's always one way of looking at it on one side and another way of looking at it on the other side. And part of the process I think of self build is navigating that and deciding where the balance is and what compromises you are going to make and then trying not to beat yourself up when you realise you've maybe made the wrong one sometimes and enjoying the ones you did make right!

Ben: And tell me about it now, what it's done for your life? Living in this house that's got this extra space and thermal comfort, not thinking about the summer too much!

John: [John laughs.] Even the summer is good, it was annoying that it overheated! But no, it's brilliant, it's really good. We're both much

happier I think here. We were living in a mouldy, damp 70s bungalow before which was quite good for demonstrating all the things that you didn't want in a house. Big mouldy corners and big mouldy windows and mould definitely a feature! So moving here where there's none of that, it's much lighter, it's much warmer and more comfortable.

We've got the space we want. We've got our own separate spaces as well as the sort of shared space. It's brilliant really. We're still finding those spaces. The space we're sat in was boxes and rubbish until kind of a couple of hours before you got here, so it's an ongoing process! But it's really good. It feels really good to be here.

Ben: I'm glad to have been the trigger for that, the tidy up in your office!
John, thank you very much.

John: [John laughs.] You're very welcome, thank you.