

Episode 42

Can a Straw Bale House Reach Passivhaus Standard?

The show notes: www.houseplanninghelp.com/42

Intro: Fran Bradshaw is from Anne Thorne Architects, a practice that's always had a focus on sustainability and community-based work. Fran was a builder before she became an architect and she's very much interested in the practical side of things as well. So for this interview we're going to focus on a straw bale house that she's building for herself. It aims to meet the Passivhaus standard and before we got onto that project I was asking her about whether she'd done anything like this in London, because Anne Thorne Architects are based in the middle of London so I wondered whether she'd had any cause to use straw in the past.

Fran: Yeah, we did our first straw bale project in London which is a small visitors centre in the park in Tottenham and that was really what made me want to use the same technology for my own house because I thought it was really wonderful.

Ben: So, tell a little bit more about that.

Fran: What was really great about that was that it was part of the original plan from the friends group about how they would get the whole project going was to do something which people could really be involved in the building work on site. So they were going to be involved in the design of the building but also that they could be involved in building it.

So from the very beginning when we did the Heritage Lottery funding application we had an idea that it would be a straw bale building so we were designing it with that in mind and that carried through and it was done in straw and it was built by local people. It was really exciting being on site and just seeing how enthusiastic people were and what a great community benefit it was.

Ben: What element of that did you want to bring to your own build?

Fran: Two things. One, I really liked it that my friends and family would join in and help build this new house, which is such an exciting thing to do but what I really noticed on the completion of the

building in Harringay was the quality of the environment and the way that people commented and noticed what it felt like to be in the building.

And I think a lot of that was to do with the feeling of buildings that are built of natural materials that affect lots of different sensory things like the acoustics, the humidity and the colours, what you see. So the whole thing comes together to give you a very different feeling of being in that building and it's a very lovely feeling.

Lots of people talked about the building being quite beautiful. I thought that was very interesting because it's not a kind of obviously beautiful from the outside. You would not say: "Oh, what a beautiful building," in like Georgian house, pretty kind of way at all. It's something about the quality that you feel when you're in it.

Ben: Have there actually been any straw bale Passivhauses in the world yet?

Fran: Yes.

Ben: There have.

Fran: Yes, not in this country but there are some people working on the continent who have done some really interesting work.

Ben: What are the challenges then to get to Passivhaus with a straw bale construction?

Fran: Well it's more in the detailing. I mean, there is some sort of scepticism about the thermal performance of straw but I think that has been fairly well evidenced over a number of projects and there's some work that's been done in Germany around that.

But the detail of how you turn this rather chaotic piece of building material into something which is actually very precise because to achieve Passivhaus you need to make sure that all your details on all the joints are very neat and carefully airtight. So I think that's really the main challenge.

We work with Straw Works who are the people who have been doing straw bale building in this country for a long time and who have got loads of experience of working with people who haven't done it. I mean that is what's so great about straw. It's not that it isn't a skilful thing, it is a skilful thing, you do need to know quite a lot to do it well but you don't need everybody to be experienced.

Whereas to achieve a beautiful brick wall everyone who is actually building needs to really have experience building it, to build a good straw bale building you need, you know, you need Straw Works, you need one or two people who really know what they're doing but the rest are just people who need to be interested and want to do a good job and maybe with a bit of practical experience.

Ben: Is it plentiful as a material?

Fran: Yeah, it's a waste material effectively. The straw bales that we're using for building are the ones that are baled mostly for horses and animals so they're the biggest bales that you can manually move around. Those balers that produce that size are still used because people need them, you know, people who have got animals, horses, whatever do need them. So they're still part of the agricultural scenery.

Ben: Thinking about the build and the design that you've gone for, was this something that was just always in your mind - your dream home? Perhaps you could tell us a little bit about the plot and how you got everything together.

Fran: Yes, I was really lucky to build a house for myself 20 years ago in London and at that time we were working on timber frame buildings and looking at what we called then breathing wall construction, which I still think is a very nice simple, effective way of building. I suppose building for yourself just gives you the possibility of exploring something where you're taking all the risk. You don't need to find somebody who's prepared to experiment for you - you can do it yourself. That makes it really good fun.

I'm a terrible believer in what I believe in so I feel very confident that this will work. It doesn't feel such a big risk as it might do to someone who hasn't got any experience of it. Given that we're working with a straw bale building and it's so interesting and I could see that there are things we'd done at the environment centre that we could do better this time round it was the obvious thing to do.

Then the site is a village site and it's right by the Norfolk broads which has got a tradition of reed thatch as a roofing material and I found that the thatch was being cut a mile away from the site so it was just too tempting, you know.

Ben: While we're on that subject because it does interest me a lot. I have my wife always saying that she'd like a thatch and then I think how

practical is this? So maybe I can ask you now. What is the situation? Was this difficult to incorporate in or just fine?

Fran: No, it's absolutely no problem. There's loads of, well, there are good thatchers, there's a good thatching industry. It's small. It's mostly rethatching existing buildings. I was used to, sort of, having been in a thatched house I knew the things that people are worried about. Yeah, it's just a very good roofing material. It's very durable. It's got a natural insulation value so there was no reason not to use it. I mean it's more expensive going with thatch rather than clay tiles or something and that was my extravagance really. I was lucky to be able to do it.

Ben: Could you not go down there and cut it yourself?! [Ben laughs.]

Fran: No, the reed cutting is a pretty skilful business but the people who reed cut they cut their patch so they have long contracts. That's their patch. The reed quality is partly to do with how well and methodically it's cut because what you're looking for is reeds that are all the same strength, same length and same diameter. And that's a result of the bed being well cut each year.

Then actual thatching is really skilful. It's really great to watch because there's a very lovely rhythm to it and the way they turn these kind of bundles of plants into this immaculate roof is just wonderful.

Ben: How does it work when you're trying to create an air barrier? Presumably that's not the actual airtightness layer?

Fran: No, we've laid the thatch on a fireboard and that board is moisture permeable but airtight and it's taped at the joints so that's the airtight layer just underneath the thatch. You know, the thatch is then not airtight but it's still quite compact and it does have an insulation value.

Ben: When we're looking at this house, you've clearly gone out of your way to try and incorporate natural materials but are there any points that you have to resort to something . . . For example, what have you done in the foundations?

Fran: Yeah, because we were going for Passivhaus the connections between the walls and the floor is always a tricky one. I decided to go with the reinforced concrete slab there, which is quite economical on concrete but still obviously you are using concrete. You could have done it differently but I wanted to work with a local

contractor as well as bringing in some quite specialist people, like for the straw bale and the timber frame and so on. I just thought I wanted to start with something they felt really confident about so there was a kind of level of compromise there.

Ben: The timber frame . . . I know that because I came there on a day when you were actually doing quite an unusual test . . . I don't think I realised that when I arrived but I certainly did once I'd completed the video and put it all together. So I apologise if I've misinterpreted what was going on that day on the video. But it does give a good visual representation of the house and I know that the airtightness layer is on the outside, so maybe you could explain what it is because we're talking about natural materials?

Fran: Yeah, normally you would do the airtightness layer on the inside because you don't want warm, moist air to go from the room into the wall fabric. In this case, because there's a timber inside and the straw is outside the timber frame, it would have been very difficult to make the airtight barrier work well inside because you've got all these timber penetrations and quite big bits of timber, so there are shakes and so on in the timber. It would have been really hard to achieve the airtightness.

We went with Paul Jennings who was our airtightness expert, advisor, we decided to go for using the outside layer of the render as the airtight layer. So the concrete slab is the airtight layer in the ground and then you're connecting that to the render on the outside of the straw walls and then you're connecting that to the fireboard on the roof.

There are certain theoretical risks with doing that because inside you've got clay plaster and that effectively is airtight as well but for instance at the windows where it's all taped it's on the outside so theoretically you could get moist air going at the junction between the internal plaster and the window and condensing within the straw. That is a theoretical risk but in practice because all the materials are moisture permeable and hygroscopic as well, the likelihood of that - and also because you've got MVHR ventilation at the coldest times working - so the likelihood of it being an actual problem is, well we feel pretty confident that it won't be a problem.

It's been very interesting discussing it all and what we agreed with, particularly with Peter Warm who are the certifiers for Passivhaus was that we would install moisture monitors so we can actually see how the straw is performing. In fact there's so little research going on about these natural materials that I'm very pleased that we'll be

able to contribute something towards a better understanding of how these materials do perform. Obviously if there is a problem then there are ways that we can rectify it but given that whole design route I think it was quite a sensible way to solve the airtightness problems.

Ben: Let me see if I understand this. So you will have moisture that will be coming through the building? It is breathable and that's how you've designed it?

Fran: Yes, all the materials, apart from the concrete slab, are moisture permeable.

Ben: Will you notice that at all inside the house?

Fran: No, I don't think you . . . Well the way that you notice it is something different. What clay, the internal plaster is clay, and what clay and straw and those kind of materials do is that they absorb moisture. So if you've got, say you've got a particularly humid day, some of the moisture is actually absorbed into the clay and then, you know, the next day it's windy and it dries out it then breathes it out again. A bit like those sports clothing, that whole idea of wicking away. What that means is that you get a sort of modified humidity - it's much more stable. And it's more stable in terms of thermally as well. So the internal air quality is much more even, so that's the way in which you observe this whole quality of moisture permeability.

In our practice we're doing quite a lot of work with existing buildings as well as new buildings. In new buildings you've really got a choice. You can go for a moisture permeable approach to building or you can go for keeping all the moisture out, the moisture sealed kind of approach but when you're working with existing buildings you really don't have that choice. There are very few existing buildings where you have the possibility of really keeping moisture out.

Ben: This might be a good time to bring in a question that you had about this and it's from Daniel Mascall in Bath, who wanted to know how are you dealing with the affects of cracking due to shrinkage and movement? And what will that affect have on the airtightness?

Fran: Yes, you've got to maintain both lime plaster and clay plaster. There will be cracking and we'll repair the cracks.

Ben: How often do you foresee that happening?

Fran: Well I imagine that there'll be, as you would normally have at the end of a drying out period, maybe next summer there will be cracks to deal with. Then after that I don't know. I mean, lime render is much more flexible than the cement based renders. It may be that there isn't very much cracking but I think you have to accept that that could be something you have to deal with.

Ben: How many air tests have you had now?

Fran: Well just two. I mean, really the one that we did with you was not really an air test, so we were looking for figures. It was more an exploration of how straw performs which was set up by Barbara from Straw Works.

The first air test we did a few weeks after that was when the airtight barrier was complete and we got a figure of just under one air change an hour.

Ben: At that point then, are there areas that you can see are weak? Because when I was there I witnessed going around and seeing where the leaks were. Obviously we knew it was a long way from finished but did you do the same thing?

Fran: Yes, we did identify a few small places and we fixed them and retested. It made a very slight difference. Then after that, what Paul thinks is that it's disaggregated kind of around the whole building. So when we've completed all the plaster on the inside and we've put insulation in the roof and tacked it, then that'll be the time to retest it again and to see if that's made a difference.

Ben: What insulation have you got in the roof?

Fran: We're going to be putting Warmcel in between the plasterboard and the underside of the fireboard.

Ben: That's the cellulose, is that right?

Fran: Yes, recycled newspaper.

Ben: I'm learning. [Ben laughs.] Just thinking about a couple of the items that I noticed. For example, the windows I was quite surprised to see that you had wooden windows. Is that something very new on the market?

Fran: No, wooden windows have been on the market forever. [Fran laughs.]

Ben: Okay, that was silly. I walked into that one! [Ben and Fran laugh.]
Wooden Passivhaus certified windows or not?

Fran: No, there have been wooden Passivhaus certified windows as well but what was different about these windows - and they were just certified at the Passivhaus Conference this year - is that they don't have is that they don't have a foamed insulation in the middle so they rely on the timber to achieve the thermal performance. And they're very deep so that they're about just under 150mm deep. That works pretty well in the straw bale wall because the wall itself is so deep whereas there could be situations in which that was not appropriate but for this particular house they were spot on for us really. Then you use wood fibreboard overlapping the windows on the outside so you've got a kind of insulated reveal that the window's sitting in.

Ben: Have there been any parts of the airtight barrier that you've had to reinforce in some way?

Fran: No, it's . . . One thing that was really interesting was that because the timber frame went up and then the roof board went on and then the straw bale, we were working inside because it's really important that the straw bale is kept dry. Some of the joints you had to kind of imagine, oh this is going to be joining onto that and it wasn't actually there. Some of the people working on site found that quite difficult so there were some places where we had to, you know, where the line wasn't in quite the right place and we had to adjust it but that was reasonably doable.

Ben: As you get towards the end of it I'm sure you're very excited to move in but have there been any learnings of this project, things that you would recommend to others who might like to go down this route?

Fran: Well I think the airtightness is really interesting working with these kind of materials because you've got to be very, very precise and on the whole that's not quite the way people work on site in this country.

I can see there's a sort of role for someone who's the very precise airtightness geek person who's just got their eye on things and saying, oh no that's got to be just that much tighter here.

And I think that I'm going to be interested to see how as Passivhaus moves more into the mainstream and people are doing it more and

more, how that will develop within building firms, whether there will tend to be someone who is that person or whether that approach will be taken on by a broader group of people.

The other thing is fitting the windows because that also needs to be very, very precise because as you can imagine the windows don't open and close properly unless they're absolutely fixed and also the thermal seal all around them needs to be spot on and we were using this wide compression seal material which I think is really good for fixing windows. So that's also another area where you've got to be very, very precise.

In a way there are certain key moments where you've got to be absolutely spot on and knowing where those are, planning for that and making sure that there are the right people around at the time, I think that was really interesting for me to see that those are different moments.

Ben: Is it important for you to reach the Passivhaus standard or is that just something that would be great to be able to certify it?

Fran: Yeah, I'd really like to certify it because it's a language that we all understand. Either you've achieved it or you haven't. If we don't achieve it, that's okay, we'll have got very near it and the difference in the building performance between not quite achieving it and achieving it is really quite small.

It's just very exciting for me to have this house and this opportunity to live in it so we'll just see how it goes.

Ben: In terms of costs, have there been any key areas that have been where the money has gone . . . That nice roof that you've got! [Ben laughs.]

Fran: Yeah, yeah. The thatch was more expensive. Other things were quite swings and roundabouts, I think. So, the timber frame which is a beautiful, primary frame . . . Timber's obviously not as cheap as an off-the-peg timber frame but the timber frame people that we worked with, the timber frame company, are very experienced and very economical and did a beautiful job.

Obviously you can do all these things cheaper, so what was a great pleasure for me here on this job was to be able to work with people who I knew were going to do a really lovely job and to enjoy doing that together. And I think it's been reasonably economical given the lovely materials and so on that we've got.

Ben: Is there any way that we can make sure that we somehow get a project where we can have the best of everything. What are your tips for a self-builder who wants to build with quality but might somehow find things tough going?

Fran: Well, I think one thing is to look carefully at what people have done and trust your judgement about people. So if you meet someone and you really think that they've done a really good job, I mean, obviously there's a certain element of trust and you do make personal judgements about those people.

For work like this I'm not in favour of endless competitive tendering. I mean there are things where I've got a couple of prices for things but on the whole I think those kind of people who I enjoy working with charge a reasonable rate for what they do and I'm happy to pay them for it.

Ben: And finally, is there any aspect of this build that we haven't touched on that actually it's quite important that we do mention?

Fran: I think it's quite important how it relates to the other buildings in the village. That's been really interesting. Loads of people in the village have come to see and we had a big open day just as we completed the render on the outside. People love it. It's partly, I think, these materials that they can really connect to and I would like to think also it's the way that I've designed it. [Fran laughs.] That it sits well on the site in relation to other buildings and relates to them in a way that feels right.

Ben: I think it's a building that my wife would really like to see so hopefully at some point I will be able to drag her to come and take a look but thank you very much, some great information today. Fran, I really appreciate that.

Fran: Thank you.