HOUSE PLANNING HELP

Episode 225

How to create a load-bearing straw bale Passivhaus home - with Andrew Goodman

The show notes: www.houseplanninghelp.com/225

Ben: Tell me about yourself, your background and what you're interested in.

Andrew: I've been working by myself for over twenty-five years now, as an architect. Quite a lot of that time as a sole practitioner; currently I'm working as a sole practitioner. I did have a spell of working for a practice in Cambridge on slightly bigger projects before I started my own practice.

I'm based in Hertford and work tends to cover the south east of England up into East Anglia including Suffolk.

Ben: I often see you on your bicycle because you're a local. We've often talked that we should get you on to the podcast, and this is just the perfect reason because we're talking about Haven Cottage. So when did you first get an inkling that you'd be involved on this project?

Andrew: I had a phone call one day from Dave Howorth and he said he wanted to build a passivhaus but he wanted to build it using straw bales, and that it also needed to achieve the Lifetime Home Standard, which was current at the time, because it was going to be his and his wife Mabel's retirement home.

Ben: Maybe it makes sense to get a little bit of background about him because he was quite involved on this project.

Andrew: Yes. He had become interested in straw bale construction and had participated in one of Straw Works projects, I think building the council housing at Kesteven, somewhere up in Lincolnshire, and had become convinced that it was a really good way to build. He was also attracted by the affordability of it.

Ben: What was the site like at this stage? Had it been secured?

Andrew: Yes, he had just purchased the site. He'd spent several years looking though, as is often the case with people looking for self-build plots. It had a planning permission for a chalet style bungalow, which wasn't ever going to lend itself to being either straw bale or really to work to the Passivhaus standard.

It was also within the curtilage of a very old listed dwelling with a thatched roof and lime plastered walls. So, we tended to use that as our starting point to evolve a different design that was best suited to meet the brief.

Ben: So, explain about the potential of the plot and then maybe lead on to what was on the brief.

Andrew: I think one of the key things about the plot was that actually, the rear, more private garden space, was on the south side of the building, and it was an established orchard of predominantly apple trees as well; apple and pear trees. A lovely setting with open fields beyond, right on the edge of the village.

Otherwise, the trees around the site were going to have some impact on shading the building but actually probably in a positive way rather than a negative way of keeping out the sun and the potential for solar gain.

Ben: And the brief?

Andrew: The brief, as a Lifetime home, basically it was still three main bedrooms and living accommodation, separate kitchen, dining, living room.

We incorporated the Lifetime element really by providing an extra reception room on the ground floor with its own access to a wet room, a shower room, so that could be the bedroom if mobility needs in the future meant it was more difficult to perhaps sleep upstairs.

Ben: You've alluded to the fact that the Lifetime has gone now, but what was it about? What was at the core of it?

Andrew: The Lifetime Home standard had twelve or fifteen categories covering how one could approach the building, particularly in a wheelchair or with restricted mobility, car parking in close proximity et cetera, and then move through the building to make sure that one could circulate and move with ease. And if there was more than one floor level, that there was a way and means to actually move between the two levels.

It could be a staircase but a stairlift in the future, or it could be future provision of a platform lift with an aperture preformed in the floor as you built it, ready for that eventuality in the future.

Other things around sanitary provision, bathrooms, WCs and so on, and sufficient space, more than you might normally find incorporated in your conventional developer housing.

It's been subsumed now into the Building Regulations but with perhaps not enough teeth to it.

Ben: How did the design develop then? You had these elements of the brief, you also had straw bale coming into it. How did you begin to put this into your designs?

Andrew: I think a key determinant was just bearing in mind that it had to be built from straw bale. So, the idea of keeping the form of the building simple, which is a good approach if you're wanting to achieve the Passivhaus standard as well. It's a good starting point. We also wanted to have full height really over the whole of the first floor, rather than the restricted head room you get with chalet style bungalows. And we just saw around in the area, several Dutch barns with the curved roofs and wondered if that, in the local vernacular, would be a good starting point to make a dwelling from.

That's really how we started.

Ben: Was there much of an evolution in that process, because that is pretty much what you finished up with?

Andrew: There were a few iterations leading up to the design that's got built. We did go through a pre-application process with the planners which was basically positive. A few suggestions and a few modifications on the basis of that. But otherwise, from that point, it was pretty much what's been built.

Ben: How did you deal with the planning permission? You mentioned there was planning permission so, what did it take to get this finalised and agreed?

Andrew: I think the building we were proposing was pretty much the same floor space as what had been permitted. So, that's quite helpful. It was just a question of whether the form of the building, which was very different, and the finishes were very different, whether that would be considered to be appropriate within close proximity of this listed building.

The consensus was, certainly from the local planning authority, that yes, this was acceptable.

Ben: It's quite a contemporary building. That's one of the elements that I like. Was it always going that way? Because you can go the other way. We're going to mention Fran in a minute, who you work with from time to time. How did that side of things come into play?

Andrew: I think during my professional career, I've always tended to approach building in a more historic context, in a contemporary way. It's just a way to acknowledge the qualities of the historic building and not to try and do a poor copy or a pastiche, even worse. I would always aim to try and avoid that.

There obviously then is always the discussion, depending from which standpoint you come from within the conservation world, as to what is appropriate in terms of form, what is appropriate in terms of materials and so on.

Ben: Fran Bradshaw attempted to build a load-bearing straw bale passivhaus and just missed out. Has she given any input to this project or was it coming more from Straw Works?

Andrew: I had an assistant called Abby Davis working for me at the time who was doing her Part Two RIBA course at the Centre for Alternative Technology. She was just convinced that load-bearing straw bale was the best way to use straw bales. And if one uses the wet plaster on the inside as the air barrier, then why should that be any different from using that on a brick block cavity wall?

We realised that Fran has this lovely structural timber primary frame and so, the straw bales are not quite perhaps load-bearing in the same way. They are compressed and they are loaded, but not quite as much as we always intended for Haven Cottage. That might be one reason that the airtightness at Haven Cottage was achieved to the Passivhaus standard.

Ben: What was on the outside, the render?

Andrew: There's also a lime render on the outside.

Ben: So, it's the same as Fran's from the surfaces on the inside and outside?

Andrew: I think so, pretty much. She may have used clay internally. I think the plasterer that Dave worked with just was happy and suggested that a lime internal plaster mix would be good.

Ben: When we talk about compressed straw, how do you do that to make sure that you're going to hit the airtightness?

Andrew: There's some standard techniques that involve building your straw bale, in the first instance, from the ground floor up to the underside of the first floor. And before you start constructing the actual first floor, there's a ring beam or part of a ring beam that gets placed, that can be then used to compress using wires that run from the base plate up to the top plate at that point, that then get tightened. There are other techniques involving straps which can be tensioned, and some people apparently will just load up the wall or perhaps build the floor and load up the wall all around the edge with huge bags of sand; anything of great weight.

You'll get a typical compression of, I think, about fifty millimetres for each storey height. Then, once it's compressed, you load it up with the next level of construction, your first floor, and then the straw bale walls from first floor up to the underside of the roof.

Ben: Are you expecting any degradation of this airtightness layer?

Andrew: I'm not, no. But it would be wonderful to do some airtightness testing in ten years' time, twenty years' time, just to see if there is any degradation. I expect that straw bale will always move a little bit more than other materials. All materials can move and crack and could still cause problems from that point of view.

We used airtightness tapes to connect the windows to the wet plaster reveals which was a fairly conventional approach to making that connection. Whether there will be any additional movements around the window frames, it's hard to say.

I think anyone who lives in a straw bale house does get quite concerned and anxious about the outer layer of lime render because if that cracks, that can obviously allow moisture ingress which can be detrimental to the straw bale itself. Not necessarily in terms of airtightness. But I think if you apply the same rigour just to looking at your building, seeing how it is, checking the plaster and the renders, and keeping it in good condition, that should help.

Ben: Can you go around the whole building for the airtightness layer? Does it change much from the base to the top?

Andrew: The foundation is an insulated slab system. Then there needs to be a taped connection between that slab and your internal wall finish which crosses over the base plate detail that you need on any straw bale construction.

We did not build in first floor joists into the walls. We used a ledger beam approach attached to the box beam, so that there's a membrane between the ledger beam and the box beam that connects the two plaster layers, the ground floor and first floor.

Then the roof, which is a curved roof, uses a standard Intello membrane on the underside of the timber structure, which again is then connected to the render at first floor level.

Ben: So, this building has that Dutch barn feel. How have you created the roof for it?

Andrew: With the structural engineer, we worked out a system of curved laminated beams that are actually within the overall depth of the roof. The roof has four-hundred millimetres of Warmcel insulation. The laminated beams are only three-hundred millimetres deep. So, we've got a double joist system that minimises thermal bridges, loses the curved laminated beams – perhaps unfortunately, but it keeps the underside of the ceiling simpler and therefore the Intello membrane just runs in a very, very simple way.

Ben: How was this procured?

Andrew: Dave basically took the decision, and he was in a position where he was able to take, twelve months sabbatical from work, unpaid leave. He managed the construction. There was a specialist substructure and groundworker who did the slab and drains and anything below the ground. He located a couple of carpenters who he worked with throughout the job in a collaborative way who did any of the timber elements. Straw Works provided teams of people to build the walls in their usual method, providing training to people who are interested in learning about the skills of straw bale construction. And there was a specialist roofing contractor. So, he managed the construction in that respect.

I think he did all the airtightness taping himself and that probably was a good idea. I think he installed most of the MVHR system as well, himself.

Ben: So, quite a practical man?

Andrew: Yes, very much so.

Ben: What were the biggest challenges on this project, on site?

Andrew: I think he had hoped to complete it within twelve months and he just found that it extended over that time frame. So, keeping to his original time frame just proved awkward.

Ben: And your involvement then, were you just providing the designs? What was the service you were providing?

Andrew: Whilst it was on site, we just came and checked a few things at key stages and answered queries that had arisen during that time that we hadn't perhaps answered over the phone; witnessed the initial airtightness test just to check that things were performing as we'd hoped.

Ben: Were there any challenges in terms of getting to Passivhaus?

Andrew: No, apart from we had designed the building and built our PHPP model using a gas-fired boiler for heating. And partly as a cost saving measure, Dave said, 'what if I don't install the gas main?' There's a duct into the building which a gas main could be fitted into in the future, should someone want to do that, but fortunately with the introduction of PHPP 9, the primary energy renewables option enabled it to be certified. Without that, it wouldn't have been certifiable because it's electric-only heating.

Ben: So, if, at this stage, it hasn't got a heating system, what is getting that extra bit of heat or are they just putting on some jumpers in the winter?

Andrew: Well, the biggest complaint I've had about the building is Mabel hasn't been able to wear her warm woolly jumpers and socks!

No, there's post heater in the MVHR system and three other direct heaters, one in the hallway and two in each of the bathrooms that just provide additional heat.

Ben: What is this post heater, just to find out a bit more about that?

Andrew: I think it's a two kilowatt element that is situated in the supply ductwork that's heading off to the rooms where air is being supplied, that just raises the temperature a little bit above whatever it has come through the heat exchanger with.

Ben: Does this project have any solar PV or any renewables?

Andrew: It has solar PV and that's used primarily to heat a thermal store, up to a temperature, the thermostat for that is set at ninety-five degrees centigrade, as a secondary top-up emersion heater, if that's required.

So, in the summer, it seems to be providing all domestic hot water that's needed. In the winter, there's a need to use a bit of Grid electricity to top it up. But Passivhaus Plus Magazine has calculated that the building is actually making a profit on the electricity side. So, I guess that's a good thing.

Ben: This project was actually completed a couple of years ago. How do you look back on it now?

Andrew: I certainly feel that for Dave and Mabel, it's an incredible achievement, really. It was a pleasure to be able to be part of it.

I would love to build more straw bale buildings. I'm not convinced it's a solution to our mass housing needs but there is definitely a place for it, especially within the self-build world, because of that collaborative nature of the process itself.

Ben: Have you learnt anything about straw bale building during this?

Andrew: Well, I knew nothing about straw bale building.

Ben: Did that not concern you going in?

Andrew: No, because there is sufficient information around to understand what is the normal and from that work out how to perhaps do something slightly different in order to meet the needs of achieving the Passivhaus standard.

Ben: One of the things that scared me off straw bale building was thinking about insurance and finance, should anyone be coming to buy the house. Was Dave just not worried about that?

Andrew: I don't think he worried about that. It's not been a problem for him, in his particular situation. But I could see that it's not always straightforward, either to borrow or to insure straw bale buildings.

Ben: Andrew, I really appreciated having a look at this case study in detail. Thank you very much.

Andrew: Thank you.