HOUSE PLANNING HELP

Episode 273

A hemp house that also minimises plastic use – with Paloma Gormley

The show notes: www.houseplanninghelp.com/273

Paloma: I studied as an architect, did my undergrad in a kind of traditional way I guess, at quite an old-school university that was very interested in all of the pragmatics of a building and I think maybe that's where my interest in the pragmatics of building came from.

Then in my third year of studying, I got an offer to build a café on the roof of a car park in Peckham. I thought that sounded like a good thing to do. So, I designed this small bar on the roof of this car park in the last few months of studying. Then pretty much the day after completing my exams, I went down there and started building it.

I did this with a friend from university called Lettice, and I think because we were incredibly inexperienced on all fronts, we had no idea how it would work to think about getting a contractor involved. So, it was the obvious choice to go and build it ourselves.

We spent two, maybe three weeks on the roof of this car park learning how to use power tools which we'd bought from Tesco and knocked up this bar which then became incredibly popular. This was ten years ago and it's still being put up every summer now.

Ben: What an introduction! Today we want to talk about a slightly different project and also material, I suppose.

Let's start with the material, actually. What is hemp?

Paloma: Hemp is a plant that is in the cannabis family so, you'll be very familiar with it, I'm sure. But the industrial hemp is a genus of the plant that has very low THC, which is the psychoactive element of the plant.

It's legal to grow it with a licence in the UK and the plant has a multitude of uses. I think every element of the plant is highly valuable in a functional sense, not necessarily in an economic sense. But the fibre, for example, you'll be very familiar with in the

form of rope, linen, in jeans for centuries. It's an incredibly strong fibre that actually they've been using in the aeronautics and automobile industry for a long time but no-one's talking about it because it doesn't align with the identity of those industries.

Then there are other parts of the plant. The seed has enormous nutritional value from the oils that it contains, and then the bud can be used medicinally. And the shiv, which is the main component that we're interested in, which is essentially the straw, the stalk of the plant, can be combined with clay or the way we've been using it, with lime, to form this material that is known as hempcrete. It's essentially an insulation but it's an insulation that also has quite a lot of other properties.

Ben: Has hempcrete been around for a long time?

Paloma: It's debated. Some people say it has been seen in early seventeenth, eighteenth century buildings, and others say that it's actually quite a new combination of materials. So, although it comes from a lineage of natural materials, clay and binders etc., that actually this specific combination is a relatively new thing and has only really been around for about fifteen, twenty years.

In that time, its use hasn't grown massively. I think people have been aware of it for that long but there's just quite a lot of barriers, be they cultural or still actually legal.

Ben: It hasn't really been used, hemp as a plant, to its maximum potential, has it? There's no debating that.

Paloma: Not at all, no. Not for a long time. I think back in the Henry VIII era they were much more aware of its benefits and potential. Before the growing of it was outlawed, the cannabis plant more generally, it was an incredibly ubiquitous crop across the country.

Ben: What comes first for you? Is it this particular project that is going to use it, or have you had a long love of hemp and using it in buildings?

Paloma: My relationship with hemp began from a friend of mine who's set up a hemp farm. It's a group called Hempen and they have an amazing hemp farm in Oxfordshire. They grow for a number of different things, on a medium to small scale, and they do all of their own processing.

On another project that we did in London, it's a three storey house, he'd suggested it early on as a material and it ended up being the

most practical material for the building that we designed, which was a nice introduction and serendipity.

So, we used it in that building but in quite a different way. That was a self-build project. We used a lot of timber, a really hefty Douglas fir frame, and then cast in situ hemp, that infilled between this portal frame structure. But that project was very idiosyncratic in a way. It's got a lot of character and a lot of flavour that had quite a different intention to the more recent project at Margent Farm which is highly rationalised and pragmatic in some senses and is looking at off-site construction; so factory made.

Ben: I was just going to say that isn't one of the challenges of this getting the mix right?

Paloma: Yes. You mean of the hemp and lime?

Ben: The hempcrete.

Paloma: To an extent. You can probably learn how to get the mix right in about half-an-hour.

Ben: Okay. Not that much of a challenge then.

Paloma: Not that much of a challenge. It's about the consistency.

Ben: Or is it slow?

Paloma: Yes. There's an issue with the drying times and curing times, so depending on the binder that you use. Some of the more reliable binders have a cement content which ideally you wouldn't have. There are binders that are pure lime but they are slightly more awkward to use and either set too fast or too slow or don't hold.

So, you're right in that sense. If you're going for the purer, which we should be aspiring to, then it is a slightly finer art in terms of getting the mix.

But then the other barriers are that it sets in about twenty-four to forty-eight hours depending on the binder; it can be quicker. But then the drying times are incredibly long for what we are used to in this industry. It averages out at about three months for the building to dry out and that's slightly dependent on temperatures and air flow etc. And until it's dry, you can't apply any secondary finishes.

Ben: So taking that process off-site, how does that change things?

Paloma: It means that you're taking the wet process off-site which means that the site becomes a more streamlined construction process on-site. It's what they call a dry process. It's cleaner, less complicated. It means that the drying time can happen somewhere else before you come to the point of assembly. So, you're not waiting around. These things arrive dry and you can put whatever finish on you like. And maybe this is the most important thing, it extends the construction period.

One of the other limiting factors with hempcrete is that you don't want to be casting in winter months because there's a risk of before the hemp dries out, there's too much dampness in the wall for too long. There are all kinds of problems that can come from that. So, that can have a disastrous effect on a construction programme if suddenly you run over and then you've basically got to down tools for three or four months.

So the cassettes are arriving dry with the hemp dry and it means that you can build twelve months a year.

Ben: Is this something that is trademarked, a product that you're using, or off-site in a different sense?

Paloma: It's not trademarked and it's very simple. There's nothing particularly clever that we're doing.

Ben: You're just taking it off-site to control?

Paloma: Exactly.

Ben: Tell us about the site then in Cambridgeshire.

Paloma: The site of what we call Flat House – it's the first flat house – is itself a hemp farm. It's called Margent Farm. They have been growing forty acres of hemp and I think that might be expanded in the coming years.

Margent Farm are themselves an organisation and they're doing R&D and developing products around hemp based plastics. So, bio alternatives and solutions to plastic products. They're making a whole spectrum of things from the cladding that we developed together that's on the building which is a hemp fibre with a sugar based resin, and the sugar resin has been derived from agricultural waste. It's things like corn cobs, that central tough starchy bit in the middle of the corn cob. Things that would otherwise be incinerated or go into a waste cycle.

So, those two things are combined and then pressed and heated to a temperature of a-hundred-and-eighty degrees which is a very low temperature relative to other heat moulding processes. It's the temperature that you'd bake a potato in the oven. Then it's left to cool and they're ready to go, essentially.

I think they are coming to market in the spring.

Ben: How much of this house is actually just from the fields outside?

Paloma: I haven't actually done that calculation but it would be a very good one to do in terms of volume.

Ben: But a good chunk? I don't want to set you off on this calculation.

Paloma: My brain's ticking! Probably somewhere like sixty or seventy percent in volume. It could be substantially more actually.

So, the fibres in the sheet cladding and the hemp in-fill in the walls all come from one harvest, and there was a lot of that harvest left over. So, it's a decent amount. Then the rest of the materials are timber and cellulose things which also have a very low embodied carbon, which is maybe something that we haven't covered about hemp.

One of the reasons to use hemp is that it sequesters carbon more than most other plants during its growth. So, as it's growing, it's sequestering carbon into the body of the plant but also into the soil. And it can be used as part of crop rotations.

Ben: Am I right in thinking that it's actually a pretty good crop for growing quickly and then being used?

Paloma: It depends where you are. At Margent Farm, they do one harvest per season, per year essentially. In other countries and other regions, I think you can get two to three which is pretty good for a crop of its kind.

Ben: What else was on the brief for the house?

Paloma: I guess they wanted somewhere that had a good relationship between the house and the landscape. It was very important that it was connected. It needed to be very low embodied carbon and crucially to avoid plastic use absolutely wherever possible.

Ben: What sort of things might you instinctively be talking about?

Paloma: In terms of plastics use, it's everywhere in our contemporary buildings. Enemy number one, maybe, is polyurethane insulation. There are various brand names which we're probably all quite familiar with for that. It's the rigid foam insulation that we all know which you'll find in many, many buildings.

Sadly, more often than not, even more of it in buildings where they're reaching high ecological credentials such as Passivhaus buildings because they rely on extraordinarily low U-values. They achieve that often with rigid foam insulation.

Ben: And sometimes underneath the house.

Paloma: Yes. Polystyrene foams – most of our insulation products will be petro-based plastics.

And then the membranes, you'll have your internal vapour barrier, which is polythene, I think, and then your building paper which is another form of plastic. Most buildings are put together with sticky tapes of all different kinds and descriptions at all the different layers. And there's generally a fair amount of expanding foam that just goes here, there and everywhere to fill up all the cracks, gaps and goes around windows. Nylon thermal bricks to mediate thermal bridges between inside and out, all of the gaskets etc. that we put on the windows, uPVC windows.

It's all the stuff that I guess you don't see or becomes invisible to the eye. And then all of the stuff in the walls. Wiring, ducting, pipes, vents…

Ben: So, how did you do that?

Paloma: We didn't achieve it one-hundred percent. There are barriers in terms of costs and there are barriers in terms of certain things just don't exist. But we did pretty well.

We did that partly by returning to what is known as breathing construction which refers to not so much air-leaky buildings but buildings that can transfer moisture through the wall. So, all of our buildings previous to the last fifty years did this. They'd take moisture from the air inside a room, absorb it into the wall, and then breath it out the other side.

There are many reasons why that's a really good thing. It limits condensation, you can have a self-regulating moisture content in a room because if the moisture content in a space gets too high, it just gets pulled into the walls and then evacuated, and it means that when something goes wrong, you know it's gone wrong because

your breathing construction generally involves a much more direct relationship of materials.

It's more a case of what you see is what you get. Whereas with layered construction and petrochemical based construction, you're generally five layers away from the structure or pipes – maybe not that far away from pipes – but you're some kind of veneer. You're within a veneer of what the building is. Which is fine and it's what we've got used to. But it just means that if something goes wrong, it can be quite hard to identify it, particularly with things like leaks.

Ben: Did you have some airtightness targets and things like that, or was it that it was almost at the opposite scale of what you're doing?

Paloma: Yes, to an extent airtightness is – well, I don't know; there are people trying to convince me otherwise at the moment, but it begins to feel less relevant.

The other thing that we did was, we didn't service the building. Contemporary building methods, generally there's an expectation of effectively air conditioning which means more pipes, more ducting, more soffits, all of that stuff that we're wanting to strip away.

So, you always have to have a level of background ventilation which we used to achieve by just having slightly leaky buildings. Now we're making incredibly airtight buildings and then making intentional holes, which I think is a funny logic in a way, because so much generally plastic goes into making incredibly airtight buildings and then we're punching holes in them.

The idea is that those vents are regulated. We can close and open them. The reality is no-one closes them or often even, no-one opens them. So, often with those buildings, the background ventilation doesn't actually get activated.

Ben: On building regs., we're talking about something where you've got trickle vents.

Paloma: Exactly. It's a condition for buildings regs. that you have a certain amount of trickle vent or background ventilation. Basically, it means that the air we're breathing has enough oxygen in it and has been replaced enough times during the day without us having the window open. Which used to happen naturally because we didn't used to go so crazy on sealing up our buildings. So, it's a difficult one.

So, it's not something that we necessarily are looking to achieve fantastic rates on because we're not looking to condition that air,

extract the heat loss from it. We're looking to make well thermally insulated, incredibly low embodied carbon buildings.

Ben: What did you do for things like windows? Were they timber windows?

Paloma: They're not timber. They're aluminium, which is an incredibly high embodied energy material. But also, another factor in all of this is circular economy thinking. Aluminium is the only metal that actually gets higher quality the more times you smelt it. It's got a very high market value and it is always recycled because of that, and it's quite high functioning as well.

They could well have been timber. There were cost concerns.

The bad thing about aluminium is the energy that it takes to manufacture. Ideally, we will move to a world in which we're producing energy without producing carbon, in which case it does begin to feel like a fully responsible choice. At the moment, in terms of the carbon footprint, aluminium would not necessarily be the one to go for.

Ben: Well, no building is perfect. We just like to talk them through.

Maybe you can talk us through the construction from the foundations right up. Any challenges in construction?

Paloma: Yes. The footings were almost the most difficult bit to get right. Since building it, we've come across quite a few interesting ways to think about foundations. It's got conventional concrete foundations and then a suspended timber joisted floor.

The foundations were reasonably substantial. So, since building it, we've been looking at things like screw piles which have been around for a while. They're dependent on the type of soil that you have. You can't use them in every condition. They're essentially giant steel screws where you need a small machine that hammer drills them into the ground. They go a certain depth depending on the ground condition and depending on the weight that you're loading them up with.

The benefit of them is they're relatively low embodied carbon. Steel is still pretty high embodied carbon in its manufacture so, it's not negligible. The idea is again thinking about the circular economy models where they can be unscrewed, taken out of the ground again and used in another project.

The maybe more exciting alternative is compacted hardcore or compacted flint, compacted stone. Or even stone itself. So, using stone in blocks as pads, using compacted flint – making a trench, filling it with flint and compacting it.

There's a project that the brick factory that we work with is nearing completing and that had compacted flint foundations. The flint has literally come in from the fields surrounding the factory. So, there's a very direct relationship there. I think that's something that we're going to really explore and invest in finding a solution to because it just increasingly feels completely crazy to be putting so much concrete in the ground.

Ben: That's foundations. Walls, roof?

Paloma: The walls we developed a cassette system for. This is the innovation of the project, I guess, essentially. They're super simple. They're based around an eight-by-four sheet and they were made in a factory as boxes essentially, laid on their backs, and then we filled them up with hempcrete and dried them.

Those were brought to site and erected in two days with a crane and very simply screwed together by fixing additional pieces of timber that screw on the front.

Then the roof is just a very straightforward joisted construction – well, that's not right. They have a different name when they're in the roof – and then we used this stuff called wood fibre insulation, which is if you can imagine MDF but filled with, the lowest density MDF you can imagine

Ben: It's got a nice feeling, the wood fibre.

Paloma: Yes, it's brilliant stuff. I only found out about it relatively recently and I couldn't believe that it had taken so long. You can do everything that you can do with the rigid foam polyurethane insulation with this stuff, it's close enough to the same U-values and every builder would be able to use it in the same way that they use those other insulations. So, it's really brilliant stuff.

For an immediate solution, an accessible solution, that stuff is great. It just needs to be made in the UK and then it will be even more…

Ben: Yes, the next thing is the transportation. Is there anything else that we should know about the Flat House or the construction of it?

Paloma: The Flat House led into the establishment of an organisation called Material Cultures which is explicitly to research and explore these materials in the space of off-site construction.

At the moment, there are three massive new housebuilding factories that have gone up across the country and they're using a spectrum of materials. Some of them are using engineered timber quite a lot, but they still have some of this palette of petro-based insulation etc. So, we're really interested in finding ways to make these materials more accessible, make them more affordable, and make them available more broadly.

So, we've established this organisation called Material Cultures. It has a base at the brick factory that I mentioned. We're kind of setting up to begin manufacturing at a larger scale now, to draw from the model of the Flat House.

And then we've been working with UAL and UCL – two universities – to develop it as a research project. We've developed another prototypical building with UAL, with the students on the architecture course there at St Martin's, and those things are feeding into the broader research.

So, it feels very important to us that this project and these processes happen in a very reflective way, that we're constantly learning and moving and developing the thinking.

Ben: Have you mentioned all of the lessons you've learnt from this?

Paloma: God no, probably not. There'll be so many.

Ben: Give us a couple then.

Paloma: One of them I think has been the relationship with the client at Margent Farm. He is a filmmaker and he thinks in terms of narrative which has been an amazing exposure to a way of developing a project. Because I think I've always approached things from a maybe overly pragmatic point of view. But that entire project came from an idea and a story that he followed through from beginning to end with integrity and loyalty to the story, maybe more than the pragmatics necessarily. And I think in the end that's taken us down some extraordinary paths that we probably wouldn't have gone on anyway.

So I guess the keep romance alive in the pragmatism and reaching your end goal.

Ben: Not one that I was expecting there. How is Steve finding the house?

Paloma: They seem to love it. They're there a lot. They've got a cat that's also moved in and everyone seems very happy. It's been amazing, the project going from an idea to someone's home. It seems to be facilitating the next stages of the things that they're doing in the development of all their amazing products.

Ben: And you'd like to go down this sort of route again? It's been interesting for you?

Paloma: Absolutely, yes. I'm hooked. I'm going to be on this path for a while.

Ben: Paloma, thank you very much.

Paloma: Thank you.