

Episode 290

Being resourceful to bring down the cost of a build – with Colin Rice

The show notes: www.houseplanninghelp.com/290

Colin: Well, I was always a history man when I was an architecture student. I didn't really feel very confident about my practical skills.

I finished at Bristol in 1980 when it was a bad time, another of those recessions, and I saw an advert for a job with a guy called Lyall Addleson who used to be quite well-known because he did the AJ Handbook of Building Failures. It was for a six month job to help him with his investigations into building defects.

So, I applied, and I worked with him for two years and because he was a clever guy, I learned about how things go wrong. I learned to think about a building not as the thing that's finished when it's handed over but how it withers over time.

After I left him, he said to me, 'would you like to help me rewrite my book?' It must have been the 1960s that he'd written a series of books called Materials for Building, and the publisher, Butterworths, approached him and said, 'can we redo this?' It was eventually published in 1991 with a new title, Performance of Materials and Buildings.

There's a section at the beginning of that which really condenses what we had come through endless discussions about basic principles for buildings. Because he was always on demand to go and talk at things like the Institute of the Clerk of Works and he'd talk about principles like you should always have two lines of defence, you should always do this and do that, but condensed into these five basic principles, which are two constraints, two objectives, and a controlling principle.

These are basically just laws of physics, thermodynamics. The first constraint is high to low which applies whether you're thinking about rainfall or structure, the force of gravity from high to low, but it applies equally to things like air pressure gradients, thermal gradients, all of those things that affect the building envelope, pressures from high to low.

The other constraint we call separate lives which is the fact that a building is not done just like that, it's done through a process, and when it is done, different materials are always trying to not necessarily fight against each other but differential thermal movements, differential moisture movements – lots of defects in buildings come from ignoring those basic constraints.

That's on the constraints side. On the objectives side, there's the objective of continuity and at a big level that's a continuity of performance. So, for something like a passivhaus where you're getting a greater extreme between inside and out, to achieve that satisfactorily you have to have continuity of all kinds of things. You obviously know about this. It's the reason why having air barriers is so critical in a Passivhaus building. You're trying to manage a much greater differential between high and low and you have to do it by thinking very carefully about continuity in the face of the challenge of separate lives. How do you actually do that?

The objective that you're trying to do is to actually hold it in balance. That's the fourth principle, balance. In a way, thinking about Passivhaus, that's quite a good example. It applies to other things like when you do laminated boards. If you don't do it symmetrically then you get banana effects. So, you always have to think of balance in that way as well. But at a big scale, I always think that's a really key objective.

Then the fifth principle, the controlling one, we called creative pessimism. Sometimes it could be thought of as Murphy's Law which is basically what can go wrong at some point will. So, uncreative optimists will tell you, 'I'm sure it will be fine' when actually, if you think about what can go wrong, then you can come up with a smart solution a bit more creatively.

I've had those five principles at the back of my mind for the last nearly forty years. I really credit Lyall Addleson as my mentor.

So, the annexe at Green Tiles in a way is like a little mini manifesto of applying those principles.

Ben: Why these principles? Obviously, your career has been decades, yet you've really embraced this.

Colin: I think they actually fit in very well with the bigger drive for sustainable design, a light foot, doing things – I call it going with the flow. That's my expression now. A lot of architects, you can sometimes feel they spend five years at university or college training to create problems that they can then solve creatively rather

than actually understanding how things really work and going with the flow.

As another example, I get really distressed when I see the current craze for timber cladding on buildings where you have timber cladding which goes up the wall and over the roof. If you accept the principle of high to low, then a wall is different to a roof. Timber is a material which is faced with the constraint of decay – another high to low, entropy. You're basically trying to use it in a way that arrests it at the point of its natural decay for as long as you need it to. So, why would you put a material that you know is going to be less durable than others and less durable than it would be on a wall? Why do you pretend you can have it as a seamless covering over the roof? You can take a snapshot when it's finished, put it in Dezeen, but I can guarantee that when you go back in five or ten years' time, it will look very different.

There's a dreadful example of a really good green architect who designed a school in Devon which was done in this way and has got secret gutters at the edges of the roofs so that you couldn't see where the water goes, and it was a massive failure. It's seven-million pounds to actually rebuild it.

We don't want to do that. It's not green to behave in that way.

Ben: Maybe these principles will come out again as we discuss the Green Tiles Annexe, but I do think there's something quite interesting here. It's the context of where you are in the world and some of the challenges that this particular part of Norfolk will face in the coming hopefully decades. Maybe tell us a little bit about that then.

Colin: I've used it as an excuse for being stingy and economical. The reality is, we're on the back of the dunes where the coastline management plan says it's going to last possibly to 2100. But at the same time, we read about how actually, with global warming and climate change, sea levels may well rise faster than was predicted.

It was only in 1953 when there was an enormous great storm, a surge, and thousands of people in Holland and seven people in Sea Palling, down the coast from us, were killed in the flood, as a result of which they built the sea wall which we rely on now.

Ben: Yes, that is an active defence, isn't it?

Colin: Yes, it is. But just up the coast towards Haisborough, the cliffs are just being eroded at a phenomenal rate. So, we don't feel like we're going to be handing this on to our great-grandchildren.

Ben: So, you've got an existing house, but this project is almost a retrofit or an extension, even though it's a separate building. Maybe you can explain that one.

Colin: Yes, it's an annexe. Our little house that we bought, I've been working doing it up and we discovered that it was some kind of agricultural office, because that's what it says on the back of the doorframes. It's a timber frame building and it's about seven metres by eight metres.

It had a six berth caravan that was sitting beside it which was very handy for us because we used it as a playroom. It was a nice little place for the kids to have as their own, and then I used it as a bit of a workshop. But it basically just rusted away. The chassis went and I discovered that my materials were just literally going through the chipboard floor.

So, I applied for a planning consent for an annexe and I was very surprised to get a consent because it was an annexe that was always going to be subsidiary to the main building. They allowed it through.

Ben: What was on the brief for the annexe?

Colin: The existing house has got a really basic construction and although it's given us a great deal of pleasure was until quite recently very cold in the winter. So, we thought what we could do is, we could build an annexe where we could stay over the winter weekends when we go and be comfortable rather than rugged up and freezing cold.

That was the main thing; that it should provide overflow accommodation for family and friends to come and stay and be a base that we could use in the winter and be self-contained, therefore.

Ben: This was something that you were pretty much going to do entirely yourself with a little bit of help from the family every now and again?

Colin: Yes. I'm one of those architects who just likes making things and I realise, when I look back, I'm actually comfortable with the dry trades. I don't really like bricklaying. I've never even tried plastering but I'm very comfortable doing carpentry and joinery. So, in a way, the whole place is a piece of joinery. It's not rough, it's quite precise.

Ben: Can you explain a little bit about how the construction moved along? Because you were doing this on weekends, alternate weekends so that one weekend you're doing a bit of planning and perhaps carpentry back home, and then the next weekend you're on site. That's quite interesting in itself.

Colin: Yes. I think there's a really interesting lesson there for people who are planning to build their own house. I think when you want to do something, you just want to get started with it, but you've got to think of planning as being part of the work. On the other hand, you do need to allow for your ideas to evolve.

So, I think it is worth planning things as carefully as you can, but not being so strict with yourself that you give up opportunities for doing things a little bit better.

I kind of worked everything out pretty much, and then began doing it. And the principle of separate lives, I planned it very carefully. I sketched out what I was going to do a step at a time. And a key part of that was to buy a shipping container. We did actually look at getting a second-hand caravan to replace the caravan as a workshop, but it wasn't really possible. So, for quite a modest sum, we bought a second-hand shipping container where we could store materials.

Again, there's another lesson. If you're into self-build as well as circular economy style re-use of components, you've got to have somewhere to store things. So, I took the caravan apart. The aluminium I recycled, the trusses that made the caravan roof I kept, and in the end, I've used those to make a cupboard work area outside the container. I've only just used a bit of aluminium. There were little hoods over the vents for the caravan windows which I've used to make a windowsill.

Ben: That's another example of using your time because the quick way, just get it off the site, squash it up, it could be gone in a morning. But how long did it take you to disassemble the caravan?

Colin: It didn't take that long. It was probably a weekend. But there is time involved, and also planning what you're going to do. It's like going to the larder to make dinner when you haven't really planned. Here are my ingredients; how can I rearrange those in the best way?

Ben: Tell us about the design again. Right before you started anything, what had you done up to the point of being able to start?

Colin: Part of getting the planning consent was to have a flood strategy. We're in a very low-lying bit of land at the bottom of a hill and we

often have standing water for several months. So, we couldn't build traditional foundations.

The concept is a bit like a houseboat that's lifted out of the water. It almost looks like a houseboat. It's a timber frame that's raised off its foundations. Those foundations weren't the first idea I had, to be honest, but they're basically a simple trench six-hundred wide by four-hundred deep filled with crushed aggregate damped down, and then twenty railway sleepers laid out, and then the timber frame is just strutted off those. There's a little timber post which is a piece of wood two-hundred by seventy-five, about three-hundred high, and that holds the whole base frame off the railway sleepers so that any flood water can just flow underneath.

It's well ventilated, from the performance side of thermal and air barrier continuity. It meant it was actually very easy to detail as a complete thermal envelope.

I planned that and I knew I couldn't dig the trenches myself so, I got the local builder to do those for me. But in the meantime, I was planning all of my timber frame. Again, another top tip which is a pretty basic one and not exactly original, is to work to timber modules and sheet materials come typically, in old money, in eight foot by four foot sheets. So, I actually planned it on a two foot grid. That's six-hundred-and-ten millimetres. So, the studs are on that module, the joists are on that module, both for the floor and the roof.

The bit that was kind of innovative from a DIY point of view was actually to make the high performance C-studs myself rather than buying them off the shelf.

Ben: I think we need to talk about the budget a little bit, to see how that is influencing all of this. How did you set the budget? You know that it's going to be difficult because you don't want to invest a lot of money, the waters might rise, but this is driving so many decisions. So, tell us a little bit about setting the budget and then what that means for all of these decisions that ripple through the project.

Colin: To use quantity surveyor speak, the first variable of cost is how big it is. So, the plan was – again, because I didn't think I would get a planning consent for anything much bigger than the caravan, I wanted to make it as small as we could get away with.

The budget I set for myself was ten-thousand pounds plus VAT. So, twelve-thousand pounds. I did that before having made the other key decision that I was going to go for proper performance and

actually get building regulations approval. That may sound basic, but I think in that part of the world there's quite a lot that's being done that doesn't trouble with such matters.

That suddenly put the cost of things like glazing up because I'd been experimenting for several years with making windows out of just sheets of toughened glass with holes pre-drilled in them and then screwed on to a plywood box. I'd rebuilt the porch with a method like that, and the bathroom, and I'd done the trial for the annexe in the house as well. But the big development for that was to use double-glazed units.

Again, this is where going with the flow informs the design. This is working with the principle of high to low. We must have spent five summers when the kids were small just not able to really relax because we were having to redo the windows. The old house had single-glazed windows, traditional puttied, and beside the coast, paint and everything just lasts two or three years. So, I thought there must be a way of making a window that doesn't deteriorate.

I basically designed the wall on what I call a drip-dry principle where the sheet of glass overhangs the wall below and is overhung by the wall above. So, there's basically three thicknesses of wall: the upper level, the window level, and the bit below. I worked it out so that the insulation is shared. There's more insulation at the top than there is at the bottom. So, the sheet of glass overhangs the wall by the difference between a hundred-and-forty millimetres – so, sixty millimetres.

The double-glazed units cost a bit more. That was two-thousand pounds of my budget. In the end, I've spent double that, just under twenty-five-thousand.

Ben: It's still a very small amount. How does that equate to the cost per square metre?

Colin: It's actually just under eight-hundred-and-fifty pounds a square metre, but that includes VAT and it includes all the fitting out, carpets, curtains...

Ben: And high performance as well.

Colin: Yes.

Ben: Rewinding a little bit, I stopped you in your tracks when we were talking about I-studs, and you mentioned that you created a C-stud. If you'd gone with the I-beams, do you think that would have been a

lot more expensive? How much are you saving by doing all this work, and how much work is it compared to just buying it?

Colin: It's a good question. After the event I worked it out. I worked it out compared with solid studs and I found that if I'd actually used off the shelf hundred-and-fifty by fifty studs rather than using the ones that I'd made up myself, they would have weighed about ninety kilograms for a typical panel and cost about ninety pounds. Whereas the way I've done it, it weighs about sixty kilograms and it's cost about sixty pounds.

I can explain other reasons why this approach was advantageous and why I really would think about doing it again.

A solid stud is the vertical timber member that makes the timber frame wall, and for years people have been making those obviously out of solid bits of timber. In recent years, everyone is familiar with an I-section where you have a solid timber bit at each side separated by a thin plywood or OSB fin in the middle. There are lots of manufacturers that make these I-beams and they're really good because they're very strong, structurally efficient, and the thermal bridge caused by the stud is much less because you've only got the little thin bit in the middle.

That's basically what I've done. I've made those by cutting down a sheet of nine millimetre OSB and screwing it on to a bit of tiling batten fifty by twenty-five.

I don't think you could build a multi-storey building with that, but for a single-storey bungalow, maybe the top part of a two-storey building, it's perfectly strong enough. It means it's thermally efficient, it's lighter, so if you're doing it yourself, you can handle it more easily. With quite simple detailing, you can make it more precisely than you can a solid timber stud because of the way that the bits fit together.

So, we were able to prefabricate all the studs. Making the studs themselves took quite a lot of weekends which was a perfectly joyful experience, if I'm honest [laughter].

Ben: So, was this in your shipping container where you were doing this up in Norfolk, or was this back in Hertford?

Colin: The studs I did up in Norfolk, accompanied with blackbirds and the sparrows dancing around, and the wind in the reeds. There was just a sense of the joy of being outside.

Ben: Yes, you love that aspect of the craft that goes into it all. I guess we're working up the building. We've talked about the foundations, the timber frame. So, as we go up the building to the roof, what did you decide there?

Colin: I did the roof joists just with traditional two-twenty-five by fifty joists at six-hundred centres. They do actually span up to four-point-two metres at the widest. So, it's quite a big span. And actually, because the roof and walls are insulated by filling the cavity with recycled newspapers, Warmcel cellulose insulation, I didn't want to make it thinner where the building gets narrower. I wanted the roof joists to become an insulation holder.

So, the roof is done as a cold roof which is actually a bit out of fashion now. This is where you have the deck which actually carries the waterproof membrane designed to be cold because it's got a ventilation space under it. It's the same as the walls which have the same principle where you've got a solid bit of airtight insulation and then you've got a rain screen. We talk about rain screens for claddings, but not for roofs, but it's the same kind of physical principle that you're relying on air movement up the cavity to clear moisture and things that can cause decay of the timber.

The roof obviously has a different build up to the walls. It's got those solid joists that are filled with insulation. To hold the insulation in place, there's a thin layer of OSB on the underside. That's actually got plasterboard for fire performance to meet the building regulations. It wasn't my original plan. I'd pictured it as a plywood ceiling but to do that you'd have to fire treat it with an intumescent varnish.

That's the inside part. And then, because you've got all of those cold bridges with the joists running along, on top of that there's then a layer of twenty-five mill. of further insulation that covers all the joists. That was done by running counter-battens so that the membrane could go right over the top and that would form a two-hundred-and-fifty mill. thick zone that could be filled with the Warmcel.

Then on top of the membrane there's another, deeper, counter-batten, fifty by fifty, and that's the airspace. Then on top of that, there's eighteen mill. tongue-and-groove plywood. Then stuck on that, there's a whopping great sheet of EPDM.

Ben: Which was one of the challenges, wasn't it? Getting that up there.

Colin: Yes. My previous bits of work on the house I'd used, I don't want to do promotions but it's actually a rather good system, the Wickes Easy Lay Flat Roofing System. Self-adhesive, and it's actually very easy for the DIYer to do that. It's guaranteed for twenty years, apparently.

But there are quite a lot of joints and I realised that on paper it was cheaper to do it using an EPDM. That's a synthetic rubber that is used for roofs and is great for small buildings. You get it as a single sheet, and you stick it down and there aren't any joints. What I hadn't really taken into account was how heavy the sheet that we needed would be – eleven metres by five metres. It was a great lump of completely floppy black rubbery stuff that weighed nearly one-hundred kilograms sitting on a pallet three metres away from where it needed to be. So, the logistics of getting that on the roof were quite challenging.

We hired a Genie lift, which was fine except that I got the wrong size. So, it didn't quite get up there. We had to do a little bit of ingenuity to put the Genie lift on another platform and then lift the EPDM onto the forks of the Genie lift.

Ben: How many occasions did you need help then? What sorts of things were going on? Was it really just when you got higher up the building?

Colin: Well, in the planning stage, I needed a good engineer. Not many engineers I don't think would have been happy to calculate the second moment of inertia of homemade C-studs, but there's a guy called Geoff Morrow who has a firm called StructureMode who relishes doing things from first principles. He was very helpful in coming to test my soil to prove that even though it's completely feeble and waterlogged, that actually it could take the tiny loads that were imposed on it. He did all the calculations for the structure. So, we needed an engineer.

Who else? We had the Christmases, father and son, who did the trenches; a very nice plasterer who's got a house on the Bush Estate who came and skimmed the ceiling for us; and a very nice electrician who's got a caravan up at Haisborough who came and checked all my wiring and asked me to do a few little modifications and then signed it off for Part P for the Building Regs.

And then family and friends. My wife, Margaret, has endured my obsession, helping with a lot of the work.

Ben: So, it's certainly something that you've enjoyed the whole way through, and I don't think we can stop just with the structure. It's also what's gone into it. So, you've thought very much about the materials and re-using items.

Colin: Yes. This has almost overtaken us now as a drive, the realisation that as a society we need to be reusing rather than even recycling. We should be reusing buildings rather than knocking them down and starting again. But that just chimes with my own personality if you like. I'm a bit abstemious, I guess you could say. I call it fun with thrift. It's actually old-fashioned, thrift, using things carefully, but actually doing it in a way that's enjoyable and makes people smile.

People always smile when they see the porthole window in the bathroom in the house that's just made out of a microwave plate fixed into a hole in the wall with some clipped down cable clips.

Ben: When you're trying to source all of these things – you've talked about the shipping container and how that's there – do you just find things as you're going around? At what stage are you sourcing the items and are you under any time pressure at that point or do you then put things in and think, 'that will be useful in three months' time?

Colin: Again, that's a really good question. I haven't thrown things away that I had. I've actually still got the toilet from the caravan, but I've decided not to use it ostensibly because it uses up too much water. So, I don't throw things away; I keep offcuts because you never know when they might be useful.

Then I'm just an opportunist. The Cullinan office, we moved in 2012 and the firm had actually done quite a bit of DIY. It was very much part of the way that we thought about things at that time. We'd made these beautiful toilet cubicles out of Douglas fir plywood and one of the partners had made lovely lightweight cubicle doors, two-point-four high by a metre wide – enormous great doors but incredibly light. When we moved, all this stuff was up for grabs. So, those that were interested grabbed it.

Ben: You've got to organise picking that up, then taking it to your workshop – does that just come to you? You know it as being worth that investment?

Colin: It's a bit of a risk, isn't it? Sod's law, you throw stuff away just before you realise you could have used it.

I've actually kept things like floorboards from my first house from the 1980s in London, and I think that's probably just carrying woodworm. I should get rid of that.

But I've got lots of other bits and bobs where I think, I'm really glad I hung on to them; I found a use for them.

A tiny little example, again it was from the office. We had a modelling workshop which didn't particularly work very well, and we got rid of a bench sander. My wife Margaret used it for her sculpture until it died. And I thought, I can't just throw that away. I've got to take it apart and use some of the bits. And in there, there's a little cogged rubber drive belt. I thought, what on earth do I need to keep that for? But I've got a drop down window in the annexe where it's got a casement fastener which needs to go into a series of holes so that you can peg it down, as it were. So, what I've done is, I've cut a little strip off that rubber with its teeth on and just stuck it on the side of the frame, and then it's got little increments every quarter of an inch.

It's a small example.

Ben: Is there anything else that you could perhaps suggest to someone who wants to tackle a project in this way, that they know money is going to be tight, they're doing as much as they can for performance, they like re-use – have we mentioned all of the core principles that will take you a long way?

Colin: I think eBay and other things like that are clearly sources for materials. If you've got the space, having a shed or container where you can store stuff. Planning on a modular basis is a key way of avoiding waste.

I think there's going to be a growing network of resources that give you access to people who are trying to get rid of stuff. There will be a market facilitated by the internet to re-use things better.

The other thing, I suppose, is to design in a way that doesn't rely on masses of glue and sealants. So, asking the question, if I need to take this apart, will I be able to re-use it? I can't say I've been completely obedient on that, but I really tried not to use mastic sealants. There's a temptation particularly with decorating to go around everything and gob everything up with decorator's caulk. But actually, things can look quite good, particularly if they're timber. You can tolerate a few more gaps than you possibly can with a plastered finish.

Ben: Did you ever do any airtightness testing at all, or anything like that?

Colin: I haven't tested for airtightness, but I have been obsessive about keeping my air barrier line continuous. I could pay a few hundred pounds to get someone to come and do it, but I don't want to spend the money to test it.

In a way, the proof of the pudding is in the...

Ben: Well, maybe that's the question. How has it been? Has it delivered the comfort that you were after?

Colin: We've had one mildish winter through it so far, and it's been much more comfortable than I expected. Because the windows are a decent size. We've got a whole run of twelve-hundred square windows that are facing south-west and looking out over the open landscape, they pick up solar gain even when the sun is not shining. So, we could be sitting there in November thinking, golly this is comfortable. Why is it so comfortable? Like we did last year.

Ben: I know that a couple of times in this interview you've expressed some of the joy and satisfaction, but why? What has it been about this that has made it a very satisfying part of your career?

Colin: It's another good question. After a long time of having a fairly senior role in Cullinan Studios, it's been wonderful to be able to have an idea, plan it, execute it, and enjoy it. And I look back over the previous ten years of my career and all I can think about is writing waffly bids with a very small success rate, and I didn't do architecture to do that.

Ben: So, it's almost having that whole control and following everything of the build?

Colin: Yes. I've got another little story about this.

I was on a walking holiday with a friend a couple of years ago and we found ourselves in Keld, in the Yorkshire Dales, at the crossing of the Pennine Way and the Coast to Coast Path. We were doing the Coast to Coast Path and a couple of old guys, Phil and Eddie, were doing the Pennine Way.

Eddie was a draughtsman from Middlesbrough, and he had a bad leg. He'd hurt his leg in a motorcycle accident as a teenager, but it didn't stop him loving walking, even though you could hear he was in quite a bit of pain. And he said, 'I just love lying in bed thinking about what I'm going to do. I draw it and I get out and get on and do it'.

He couldn't have expressed it more clearly. It's that pleasure of imagining and turning the imagined into the real is what gets creative people doing things really.

Ben: I think that's a very good point to leave things. Colin, thank you very much for the story and all the information today.

Colin: It's been a pleasure. Thank you.