

Episode 141

What is a structural engineer? – with Andrew Collinson

The show notes: www.houseplanninghelp.com/141

Intro: We're in the middle of a mini series looking at various professions - people who you might engage on your project. Today we find out about the role of a structural engineer.

Andrew Collinson is my guest and I started by asking him to tell me a little bit about the area he works in.

Andrew: Well I'm a structural engineer and the basic job of a structural engineer is to make things stand up. So, often we will get architects' drawings and the job of the structural engineer is to make sure the foundations are suitable, that any beams that are in there are the right size, sizing up floor timbers, roof timbers, anything like that.

Ben: How do you train as a structural engineer?

Andrew: Well I did a degree course but that was mostly theory. So the training is really on the job training with a company that does this. So that's how I started.

Ben: And what would you say you learn as you go from project to project?

Andrew: Well I initially started off working for a big contractor on site doing large scale reinforced concrete work. And then I gradually moved from working on site into the design office, and having that background gives you a real understanding of the practicality of a design. So you have to produce a design that will work on site and the simpler the better because then it's most likely to be built right. If you make something complicated there's much more chance for it to be misinterpreted and got wrong.

Ben: We're coming from a self build angle here, I'm assuming not every project needs a structural engineer?

Andrew: No. A lot of them will need some engineering input and this is often done through the architect. So for a number of projects I don't actually get to meet the client or talk to the client because the architect will have designed the building and he knows which areas he needs engineering help and he just comes to someone like myself to get foundation details, things like that, beam sizes.

Ben: Let's talk about foundations because that's obviously quite important, so what do you do? What kind of research of those foundations to begin with, or are you presented with lots of facts and figures and then you build on top of that?

Andrew: Well to be honest for most jobs you know nothing about the soil. Nobody's dug in the ground and had a look so you have to take a sort of best guess that will cover most circumstances and then cover it with notes. So you write down the assumptions. You assume the ground is something suitable and these foundations will work with that. And if when they start digging they find something, the ground is very soft or they meet rock very quickly, anything that's outside those parameters, then they need to come back and ask again. Because most people don't want to go to the expense of having a site investigation.

Ben: On the whole then, are you doing the upfront work? You're hoping not to have to be called back?

Andrew: Generally I don't get called back but there are cases where things haven't worked out right. Because until you dig in the ground you might think you know what's under there but you just don't know. There could have been an old quarry there and you've got metres of fill, or the rock could outcrop or it might have been a marsh beforehand. You just don't know. So in most cases standard foundation solutions work, but there's always a few that don't.

Ben: So maybe you could outline a couple of examples of how you would go about that? Some situations that you've encountered on self builds?

Andrew: Well most cases are covered by Part A of the Building Regulations. There's a series of grand descriptions in there and depending on the loading on the wall coming onto the foundation it gives you the minimum foundation width and Building Regulations also stipulate

how deep the foundations need to be. Now this can be altered if you've got trees close by for instance and you're on clay soil.

But most cases are covered by the Building Regulations Part A and it's a question of just reading off the table. So most people could do that if they had an idea what the loading coming down the wall was.

Ben: Is there ever a reason that you'd go beyond that? They're suggesting this minimum but might there be a reason why you'd go beyond?

Andrew: Well generally Part A of the Building Regs is reasonably conservative. So I wouldn't normally expect to go larger than that unless it was outside the descriptions they give. So the normal case is where someone wants to do something that's smaller than the Building Regulations Part A document, and then it might need more careful engineering. So you go into the nitty gritty of it, and for that you would need to know what the soil conditions were.

It's that thing, until you dig in the ground you don't know what's under there so you either pay up front to get someone to come and have a look at it, or you take the risk when you dig that there might be a slight delay. So it's your choice as the builder.

Ben: And everything can be resolved, can't it? It's just time and probably money?

Andrew: Yes. As someone I worked with used to say, you can build the Cairngorms in Norfolk if you've got the money! So there's always a way round it, it's cost.

Ben: We've talked about foundations, so what about the other parts of the buildings? It seems we do almost need scenarios, don't we, to be able to dig into this... as I'm having this discussion?

Andrew: Well the sort of traditional build is masonry and that's very well covered by the Building Regulations documents because that is what the vast majority of houses are built with. Timber frame is less well covered by the documents but often that's designed by the supplier and they will have their own engineers.

The more tricky ones to get past Building Regulations are things like straw bale, cob and these very unusual structural materials that have quite a long history but because they're natural materials they are not so well defined structurally. What the strength of a cob wall is. We know it's a lot but what number do you use for that? And for

straw bale. We know it works because there's lots of straw bale houses being built, but trying to convince a building control officer that it's been designed right and it's not going to fall down can sometimes be a little more challenging.

Ben: As a structural engineer, do you also tend towards certain materials that you like or are you happy to work with cob or anything? Is that part of the challenge of the job?

Andrew: The opportunities to work with cob and straw bale and rammed earth, things like that, are very few and far between. And to build up an expertise in them takes quite a lot. There are one or two structural documents now that help with that for an engineer but to a great extent by the time the project comes to the engineer things have been sorted out to a level where you don't have a lot of input. If a building's been drawn up and it's got a certain distance as masonry, the chance of persuading them to change that to be timber frame or vice versa are very small.

So if you want to use an unusual material it's good to get the engineer at least on board and talking reasonably early. Because I certainly like to be involved early on if it's something unusual so that I've got more chance to research, to have some input, to make sure there aren't any real difficulties cropping up in the design.

But most of what I get asked to do is masonry and steel. Steel beams. But I do like where it's feasible to offer people timber, green oak or dried oak beams instead because they have a different look and also there's a lot less embedded energy within a timber beam than a steel beam. And they're not hugely bigger.

Ben: Can you compare and contrast those materials that you've just mentioned? Scenarios when you would use it. I'm assuming steel always seems to be the number one thing if you've got a huge great load. Is that right?

Andrew: Steel is very, very stiff. It's a very efficient material from an engineering point of view.

Timber, being a natural material, timber tends to move a bit more, particularly if you use green oak and then you'll get a lot of drying shrinkage which adds to the look of it. Every timber beam is different.

Every steel beam is pretty much identical. So if you're limited for head room or you want to hide the beam then steel is very good. If

you're not bothered about the look of it, if you're not going to see it, people normally opt for steel because it's readily available, it's fairly inexpensive and builders know what to do with it. You don't need someone who's used to handling timber.

But the advantages with timber are you can cut it yourself, so you can get a piece that's slightly too big and then cut it exactly on site. Whereas with steel you normally have to get someone else to cut it for you and you've got to get it right first time. But it's not too difficult.

Ben: You talked a little but about when you become involved on a project. Where exactly is that in the process and times that it varies, times that you're brought in quite late? So maybe you could pinpoint that for us?

Andrew: Normally I'm in the end of the design process for housing where all the architectural design's been sorted and they just want to make sure it stands up. On larger projects, housing estates, things like that, they tend to bring the engineer in a little bit earlier but still often the scheme design's done, there isn't a lot of scope for changing things.

So if you're looking to build something that's unusual I would recommend at least having an engineer who's got like a watching brief, just to look at the designs early on and make sure that there's nothing that's likely to cause difficulties later, because difficulties often translate into extra cost. So not necessarily doing the actual calculations early on but just giving some advice.

Ben: And will you suggest certain things? So you look through the design and do some calculations and then say actually you'd be better having this here? Is that the sort of way it works?

Andrew: Yes, you can say this will give a lot of difficulty. If we can just move that wall across a bit, do this, do that, then it doesn't materially change the room or the look of the house but it makes the engineering side so much easier and simplicity is what we're after. So that's it really.

Ben: I've always heard the reverse sometimes, that you've got to be careful when you deal with engineers because they'll create something amazing, but that's encouraging to hear this simplicity!

Andrew: Maybe not everyone has the same view as me but I just like a really simple answer where it's possible. So some people maybe like to

over engineer things and increase their job. But I like to keep things simple.

Ben: We talked about self builders perhaps not even coming into contact if they're dealing with an architect, but if we are, have you got examples of where you have dealt directly with the self builders?

Andrew: I'm on a project at the moment where the client has employed architects but he's been let down by his first engineer of choice. So he's come to me. The scheme is basically done but there's still some scope because the client is very hands on and has done a lot of research into what he wants to do, and therefore is very open to making changes.

And it's very helpful to be able to talk to a client who understands and does some research because it can be quite difficult where you're trying to talk about technical details and the client doesn't really understand. It's very refreshing to find someone who you can talk through a difficult bit of the scheme and how it could be made better and they understand and are able to make that decision as to whether to change something or not.

Now it can be a fine difference between that and an interfering client who keeps changing things! Because when you're trying to move things along quickly, change needs to be managed as a process. There's nothing wracks up bills more quickly than constant changes by the client because it can often involve going right back to square one and re-doing a whole load of stuff, which isn't readily apparent to someone who doesn't understand.

So it is important to manage changes in the right way as a client. Which doesn't mean to say that you can't change things but you need to understand there may well be consequences.

Ben: And change them at the beginning rather than at the end if possible?

Andrew: Change them at the beginning, yes. Don't change them certainly once you've got bricks and mortar or timber frame going up. Changes then need to be very carefully managed.

Ben: What's the difference between a good structural engineer and a bad one?

Andrew: I suppose a bad one is one who doesn't get on with the work at all and gives you an over engineered solution. But most of all causes

delays I would say. Now certainly round here there don't seem to be enough engineers to cope with all the work so inevitably some jobs don't get done very quickly.

Ben: Where do we go then to find a structural engineer and to know that they're one of these good ones, or one of these qualified ones?

Andrew: I think try and get a recommendation from someone. It's incredibly difficult for someone without the knowledge to know really whether it's a good design or not, and ask around. Try and find people who've used an engineer, were they happy with them? Did they produce things to a reasonable time scale? And was the cost reasonable because costs can vary hugely between engineers. So personal recommendation I think is really the way to go.

Ben: Yeah, on costs then, why do some charge more than others? I suppose this is the same in every industry, but why in your industry?

Andrew: Some of it's supply and demand. Sometimes you can get a really cheap price because someone completely underestimates the amount of work, and sometimes they overcharge because maybe they don't like the look of your job and they're thinking well if I'm going to have to do this then I want paying reasonably for it.

I think there's a lot of putting your finger in the air and just seeing what the price feels like rather than sitting down and working out the hours that you're going to spend and then costing it out that way. So I think a lot of people price things on the feel of a job. Does it feel like a £200 job, a £2,000 job?

Ben: Maybe take us through a typical either day or week, what are some of the things that you're actually doing when you work?

Andrew: I do a reasonable number of visits to properties, either when people are purchasing them and there are faults, typically cracking is the classic one. Or going to have a look where people want to take walls out.

But other than that I generally spend most of my time in the office doing work by email, working on drawings, producing calculations and it's probably over three quarters of the time is in the office and maybe up to a quarter is out doing surveys and looking at properties. And the smaller jobs typically don't require any drawing, whereas the larger jobs I find more and more people want a

drawing of what's required. It's so varied really. There isn't a typical day.

Ben: Do you use any particular software or what are we talking about when you say drawings?

Andrew: Well I use a program called Autocad for doing my drawings because it's a program I've used for many years so I'm very comfortable with it and it does far more than I'll ever need to. And I think I'm unusual in that I do most of my calculations by hand, written on paper and not using computer software. I use it where I need to where things are much more complicated but for a typical house I will produce hand written paper calculations because I find they're as quick and you use a lot less paper.

Ben: As we get towards the end of the interview, perhaps we could turn our attention to things that might not have gone so well. Are there scenarios or things that might have been avoided if a structural engineer had been involved? Have you got any stories? You probably know what I'm talking about!

Andrew: Yes. I've been called out recently where a house that was built on fairly steep ground, the retaining walls had moved quite let's say significantly. And it was evident that they'd not really been designed properly. And sometimes a confident builder will do something that he's seen before that was appropriate for one site but it really wasn't appropriate here. So the retaining wall which was holding up the driveway at the side of the house did need to be taken down and re-built correctly.

And other times, I sometimes get called in where foundation once they've started digging aren't what everyone assumed and you need to go out there quickly and have a look because people are standing, waiting.

The other one is drainage on larger projects can always be a bit tricky, putting in all the drain runs and particularly where the external levels haven't been worked out fully when you're trying to design the drain run.

Also I've been called out to jobs where beams have not been put in right and need to be sorted out and one or two slightly scary situations.

Ben: Collapsed buildings?!

Andrew: Not quite that far yet! Yes, things like cars parked incorrectly let's say, I've been asked to look at some of those and yeah, just things where people thought they could do something but it turns out they couldn't. But nothing that needed complete demolition and rebuilding yet!

Ben: Finally, maybe if you can just think of any good tips for self builders, people going into this? It can be absolutely anything.

Andrew: I would say, in terms of choosing an engineer, speak to a few and see how they feel on the phone. Do they feel a bit stand-offish, are they someone you could have a discussion with? Are they the sort of person that you would want working for you or not? Because sometimes if people don't speak to you nicely on the phone the first time, how are they going to talk to you later on? So go with your gut feel about someone.

Ben: Andrew, thank you very much.

Andrew: Thank you.