

## Episode 163

# How do you create an effective basement?

The show notes: [www.houseplanninghelp.com/163](http://www.houseplanninghelp.com/163)

**Intro:** Basements allow property owners to maximise the use of their plot especially if planning restricts development above ground. However, basement construction is not without risk. In this interview we talk to Andrew McNulty who helps architects and structural engineers with proper detailing and waterproofing methods. I started by asking him to tell us about his background.

**Andrew:** Well, I've spent an entire working life in the construction industry, from working literally as a tradesman and working up through the trades up to contracts management and up to multi-million pound projects.

I got involved in basements originally with my first one in 1975 in Chelsea Barracks, which is a long time ago. And with this modern method of construction which you are probably seeing here, something like 11 years ago. Once I'd come across it, having done many, many basements, understanding the problems connected with it, I thought this reduced a lot of the problems that are associated with basement construction.

**Ben:** When we talk about basements, are we saying anything underground?

**Andrew:** Basically, anything that's a single storey or more underground, whether used for storage, habitable space or whatever. But basically, a single storey underground and indeed more.

**Ben:** Can we have a basement anywhere we can dig down to?

**Andrew:** Absolutely. It would be the method of construction of the basement depending on surround structures, boundaries. If you're in an open field or you've got plenty of space around you, it's much more economic. But basically, you can have a basement anywhere.

**Ben:** If we think historically, when did someone come up with the idea of this? How far back are we going?

Andrew: Back to caveman really because I guess we started off there. But sensibly, in recent times in the UK, it's best probably to think back to Georgian times, Victorian times when basements were quite common. Trade was cheap to build them.

They weren't built for the same purposes as now, not generally speaking for habitable space, but generally for storage or somewhere to lock up the mad auntie. That kind of thing. Or to store coal, which was delivered on the streets.

Basically, if one thinks of Georgian or Victorian times, up until the First World War and then after the First World War or the coming of the railways really in the 1860s, 1870s to many outlying towns, there was massive population increase, land was plentiful, market gardens and these kinds of places around cities were shutting down, land became plentiful, the space wasn't needed. You had enough space for above ground development.

Ben: If we look at basements, we know there are going to be issues with moisture. So, can we dig into that and anything other challenges? You talked about that career starting a few decades ago and then you got to a turning point. Maybe you could run through some of the things that you've seen in your time.

Andrew: Well, slightly before my time but basically when we come up to the First World War, this development explosion in transportation and population, houses needed to be built quickly, particularly between the wars. There wasn't time and costs involved with basements. So, basically basements became very uncommon. They weren't necessary.

Which leads us to actually quite a modern-day problem, that many of our designers today, many of our architects who have done their training and are brilliant architects and technicians, they have very little experience of basements generally, as did their teachers because of the period since basements were common.

And that's what I like to do, to help architects and structural engineers with the proper detailing and the proper waterproofing methods. That's what I do.

Ben: If they're not done properly, what can happen to basements?

Andrew: The first and obvious one is if it's to be used for habitable space, the commonest thing is the ingress of water. There are, of course, methods of overcoming this but for producing a quality basement, in the first instance, it must be detailed properly.

By that I mean the design, the detailing of it, the junctions, the joints, where the house sits on it or the structure on top sits. That's the structure itself.

But before we get there, of course what we need to know is what the soil is like. So, the crucial first step is actually to have a proper interpretative ground investigation report. This will tell us about things like obviously, the characteristics of the soil, the soil type, plasticity levels, ground bearing pressures – in other words, how much the ground per square metre will carry – importantly, what level the ground water's at and this kind of detailed information. This is the most valuable piece of information and the best value for money one can actually obtain on the whole project. It's absolutely invaluable.

Based on that, the structural engineer designing it can then design the most economic structure to suit those conditions. So, it's absolutely vital. No structural engineer will design a basement without a full, proper, interpretative ground report. A crucial element.

Ben: Are we talking about a very limited palette of materials to construct basements? Because you're not going to have a timber frame basement.

Andrew: Yes. Properly, in my experience, which is 40-plus years now, I see all forms of construction underground. From insulated concrete formwork to brickwork to blockwork with membranes in cavities and internally.

At the end of the day, the most robust, reliable, consistent product has to be concrete. There is no question of that whatsoever. Apart from anything else, should it fail, it is totally repairable and permanently repairable because the injection systems used to carry out any repairs, for instance if we have an ingress of water, by injecting particular chemicals into the concrete wall, the concrete has a density which is great enough to resist the pressure of the injection system you are using. Essentially, it is a repairable thing.

With brickwork, blockwork and other kinds of things, you do not have this density.

But there are many, many other reasons for only choosing concrete. You want the minimum number of joints in any material you use underground. That is, for instance, joints between blockwork. You're going to get movement, you'll get any number of problems.

So, at the end of the day, concrete. It's the most robust, the most enduring and it is a material of itself which you can make watertight.

Ben: Currently in the Hub, we're looking at a case study where I've seen this basement that you're involved with and it's not just concrete, is it? It seems that there are so many different levels to it. So, I imagine this is a hugely complicated question but what else is happening in this type of basement?

Andrew: As I mentioned earlier, it's about detailing the design and getting the detailing right. But the greatest thing of all, the most consistent thing in my experience in construction is quality control. It is workmanship on site. It doesn't matter how good the material is that you're using, how well designed it is, in basement construction it's all about detail, supervision, the quality of workmanship.

With regard to other aspects of basement construction, a crucial element apart from the detailing et cetera is the design of the concrete. The concrete mix is crucial, the reinforcement, the spacing of the reinforcement which prevents concrete cracking, even minor cracking.

So, the concrete mix design, the reinforcement, the spacing, the type and any number of other technical things, possibly too technical to go into but they're absolutely crucial. It is a holistic thing, a total thing. It's the design of it, the materials that are involved, and the workmanship above all. Most defects are caused in workmanship. But regularly, I have to say, I have received drawings for schemes where the detailing will inevitably lead to problems with the ingress of water.

So, that's the major defect. One's got to stop water coming in. The next issue is things like vapour because of course you can have waterproof concrete but you can still have vapour transmitted across the wall. There are these kind of issues, ventilation which you always need whether it's natural or mechanical ventilation in order to prevent build-up of moisture internally.

There are many, many things that can go wrong. It's just careful detailing, good workmanship, good materials, properly designed materials and excellent workmanship. That's it.

Ben: What other things might we come across that this concrete we talked about is really handy for? For example, heave and things like this, this is another reason why we're going down the concrete route?

Andrew: Yes, for sure. I pause on that really because I was trying to consider a clay heave.

The soil report or the ground investigation report provides us with the information about, for instance, the anticipated movement of soils. Once you remove the overburden i.e., you dig the hole, clearly this soil at three meters or so depth will have been loaded for eons, since the world began or whatever. And therefore, the removal of this overburden, the soil that's left will spring up, will rise. It has a reaction. That reaction is always upwards.

The amount of reaction from taking the load of will depend on the type of soil you have. If you're in clay, depending on its plasticity, but generally speaking, you will have a greater sub-grade reaction i.e., that soil will rise higher than it will if you're in a non-cohesive soil like sands and similar types of material.

So, that's something an engineer has to consider within the design of the structure.

Ben: Anything else ground wise before I move on to planning?

Andrew: Water, of course, is the big thing. Ground water is a big thing particularly in many, many parts of England and particularly in the south east. I guess many others.

But this is the art here. Some of the associated costs depending on the severity of the ground water but it is not unusual at all for us to be putting basements in ground where the natural ground water level is only between a metre and two metres below the ground.

Of course, ground water varies in any event through the seasons. But it's not uncommon at all for walking around our basements, after they're completed knowing that externally, the water is above your head height. That's the art of basement construction.

The art there is of course where the skill of the ground worker comes in who's preparing the ground for you, to put your basement in, to keep that water at bay while you're constructing it. Once it's constructed, once you've finished, once you've back filled, once you've met certain requirements then there's no problem at all, the water.

Ben: When we think on a large scale of basement construction, how many companies guarantee their basements against water? I can see you shaking your head.

Andrew: This is a very complex area. Basically, it's something clients are strongly advised – if they're not themselves au-fait with the small print, the ramifications or warranties, guarantees and contractual arrangements – to take advice. It's a fact that many of the guarantees have a limited value.

For instance, most concretes used in basement construction, the in-situ concrete element will have an additive or additives to achieve certain objectives. One of the principle ones is to make the concrete flow better. You can reduce the water-cement ratio which is a crucial factor in concrete and especially in waterproof concrete. And this concrete will be guaranteed by the company who supply the additive to the ready-mix concrete supplier.

However, that guarantee – and this is across the board – is only a product guarantee and the maximum liability of the company supplying the additives is the cost of the material they supply.

That, in my view, is no good to the end user because there can be any number of contractors involved, there can be a long line of people who won't accept responsibility for it but above all for the client, the client's not interested in that. They want a watertight basement.

That's one issue with guarantees or warranties. The other one is that due to the very recent surge of the last decade or so in the number of basements now being constructed in the UK, it's brought a lot of people into the industry who perhaps don't have the background. As a result of that, bodies like in particular the NHBC carried out a survey of their claims against themselves which were confined to the problem with basements and in the five-year period between 2008 and 2013, they had 890 affected properties with claims valued at £21 million, which is a fact.

I strongly suspect as a result of that but certainly they re-wrote their own technical standards covering protection of buildings underground and several other third-party insurers (I'll name them for now because the flow will keep going and this includes LABC, Self-Build Zone and Premier) all have now withdrawn their ten-year warranties they used to grant to clients against water ingress. So, they will no longer insure against water ingress.

That cover, in any event, only came into force if the company carrying out the basement works had become insolvent and could no longer do the work themselves. But essentially, it's an area fraught with danger.

Something for clients to be aware of is the issue of warranties, the extent of those warranties and how good they are. To the best of my knowledge and having looked at the paperwork within the last few months, there is only one third-party warranty provider who will actually insure against the ingress of water and that's BLP. I'm not advertising for them but it is an area generally fraught with problems.

In any event, with basements now, there is a very, very strict control. The legislation is now very strict.

Ben: There's no such thing as an ecological basement, from what I can work out. I don't know whether you have any comments on that statement. But this brings us into planning because basements are more of a necessity through what planning inflicts on us?

Andrew: In planning terms, there are actually many advantages. And yes, it's fair to say that planning restrictions play a part in the development of basements. But what they do overcome, strictly in planning terms, having a basement obviously can provide more habitable space. For instance, it will, on a single storey dwelling, a bungalow for instance, double the size of the habitable space that's available. And that saves the pressure of the planning involvement. Things like ridge heights, the problem of overlooking neighbours, the privacy issues. In the green-belt, in areas of outstanding natural beauty, the single storey dwelling with a basement added we often provide for in the rear garden of properties because the ridge height can stay within permitted development rules. In other words, it doesn't need planning.

So, there are any number of planning issues. Another is, of course, particularly in things like green-belt and other sensitive planning areas – in fact, we built basements in national parks – it reduces the pressure on local planners for above ground development. If a property owner has sufficient habitable space with his basement which has got adequate lighting, access, ventilation and it's perfectly habitable for anything from storing cars to swimming pools to showers to bedrooms, which is very common these days, and has all these other adequate facilities that you associate with normal, above ground living, then it relieves this pressure on the planners.

It's one of the issues we put forward on behalf of clients. It helps them resist, be easier to resist and be able to argue with planners that you've got X amount underground habitable space. It is green-belt. One of the principle aims of the green-belt, of course, is to prevent interference with the openness of the green-belt i.e., more

building work, more housing, more extensions. So, it improves it in that way.

Ben: Are they looking on it more favourably in that sense, that it's underground, nobody's going to see it?

Andrew: Absolutely. Certainly, there are still some local authorities that really are stuck in the mud about this but the general, common sense approach from many local authorities and increasingly so, is that mindful that planning, amongst other things, is about the impact of a structure above ground on its surroundings, on the neighbours, whatever. Many now do take a much more liberal view of basements in so far as that they change nothing. The visual appearance of them has no impact on its surroundings, it doesn't increase the height of the building and it allows a property owner to maximise the use of their plot.

We often build very commonly in the most sensitive areas. We have put basements in green-belt, areas of outstanding natural beauty, in the national parks. They're not a problem and this reason being, there's no visual impact on the surroundings.

Ben: Do they ever have the reverse argument that when there is a lot of space and no overlooking or anything like that, saying why not build it above ground?

Andrew: They may well do. It's an uncommon reaction but it gives the opportunity to suggest, as I always do to prospective clients or those thinking of adding a basement, if they suspect for one minute their local authority, who they don't want to broach on the subject by the way but do their own research, if they think there's resistance to a basement then you follow the classic planning application route.

You put in your application for the dwelling as you want it, to get the maximum footprint you want or you can obtain above ground. You make no mention of a basement. You establish the principle of the new house or the rebuild or whatever. You then go back in for the basement, make a subsequent application for the basement. It makes it very, very difficult for a local authority to resist the basement. But establish the principle of the above ground development first, then go for your basement, where you believe your local authority may present you with problems.

It is the way to go because in fact, it's the reverse argument – I should've perhaps put this first. They're more likely if you go in for a basement, with a basement already under your house – and this is an argument I've heard on many occasions from various planners –

'but you have all that space underground. Here's your volume. Why do you need such a big footprint above ground?'

So, the common-sense approach is to go for the maximum you want above ground, then go for the basement.

Ben: Just a couple more things. Maybe you could talk on cost and how this might relate to what's above ground?

Andrew: It's very difficult to relate them directly but there is no question that building underground is more expensive. You're clearly involved in more excavations, there are certain measures one has to take to ensure the safety of the guys working underground, not only those excavating the thing but also those constructing the basement, the materials are expensive in concrete. But overall, if one takes everything into account, there isn't much, if at all, a greater cost per square metre and there certainly isn't for providing the basic structure.

The other important thing to remember is the basement not only provides the additional habitable space that a client might be looking for but of course, it acts as the foundation for the house anyway. So, the cost of the foundations for the conventional house really have to be deducted from the overall cost of the basement.

And bearing in mind the robustness, the period of time – the structure will outlive anybody in those terms – it is actually not so much about cost but really, value for money. That's the issue. If one actually takes a proper costing, a proper comparison between a conventional foundation for a two-storey house and a basement underneath it, mindful that one gain is all this additional habitable space and a foundation, value for money, they are excellent.

Ben: Finally, Passivhaus standard, we like energy efficient homes on the podcast. Does this complicate basements at all, or in particular Glatthaar? How many of these projects come your way?

Andrew: Passive basements and Passivhaus of course, is becoming more popular. Perhaps not popular enough and hardly encouraged by a government which has recently reduced previous standards for heat loss that it applied, which should have come into force in 2016. Presumably major business interests persuaded them not to.

Passive housing is becoming more for people who are self-building, who are looking long-term for future proofing. It involves, from the point of view of basement construction, nothing more technically in the structure itself but it's the level of insulation.

For instance, to bring the whole basement structure to passive level, one's talking typically of putting something between 250 and 300mm of insulation underneath the basement, so the whole house is sitting on it, and 200, maybe 250mm of insulation to the walls.

Insulation, for some reason, is expensive. It has to be XPS quality, it has to be extruded, it is the best form of insulation one can obtain. And of course, that which is taking the loading of the building has to be able to take a certain compressive load i.e., the total weight of the structure.

So, achievable. How many do we do? Not that many. There isn't much demand for it. Unfortunately, it's the cost of the insulation which seems to drive clients potentially to take a half-way house, to insulate it maybe onto the slab and to the walls but not to the extent of achieving passive standard.

Ben: Andrew, thank you very much for all your information today. I really appreciate it. Thank you.