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The Bigger Picture

Surveyors need to understand a building's form of construction, argues Chris Mahony, so they can identify both existing defects and potential problems

Surveyors are appointed to inspect buildings for many different reasons and all of the different forms of instruction and survey reports are well known to them. But is there a common thread that binds all of these instructions and inspections together?

Understanding the form of construction, how materials behave and their use, the history of architectural design and the principles of cause and effect are perhaps four of the most important elements. As a simple example, we know that timber joists built into solid brick walls can sometimes rot. What is just as important, however, is to understand why, in the vast majority of cases, they do not rot. The answer requires an appreciation of these principles.

What then should we be trying to understand when we first inspect a building and what can we do to help us? Surveyors have a great ability to identify defects and note problems – the missing slate, the cracked pane of glass, the poor state of decorations, the tidemark on the ground floor wall, the exposed bare wiring, the gutters full of weeds. A danger sometimes lies, however, that we write these down and photograph the property, then leave not having answered a series of simple questions, such as:

- what is the form of construction?
- what is holding it all up?
- where is the load path of the building?
- what was its original use?

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Live loads

Buildings have the ability to transfer loads in different ways. We take it for granted that we will not fall through the floor of the office we sit in every day, or that when we relocate filing cabinets the floor can take the load. But these are live loads or superimposed loads, or dynamic loads in the case of a gymnasium floor that flexes. If a chimney breast has been removed but the stack has not, the load from the remaining brickwork will have transferred to something else (if still standing). Likewise, the load from the roof or other floors will have transferred to other walls if a supporting wall has been removed. These alterations can give us more problems, e.g. if the new supports are of inadequate strength, or show signs of stress in cracking or bowing/buckling.

To help answer these questions, I often ask other surveyors how they go about their inspections. After an initial reconnaissance, sometimes accompanied by the owner or occupier, do they inspect the outside then the inside, or vice versa; or is this done top down or bottom up, or vice versa?

I do not think there is a right or wrong answer but, personally, after an initial walk around all areas (inside and out) I inspect inside first, top down, starting with the roof void if there is one. Why? It's the direction of gravity. The roof void also often allows you to step back in time and, setting to one side all the forms of construction and possible defects, it allows you to see what the roof is being supported off and, if chimneys stacks are visible outside, what is supporting them inside. It is also often the only place that is not plastered or decorated and allows you to instantly absorb much more information about the property.

The roof, of course, has to be supported somehow, and that is where the inspection of the floor immediately below it is important. If the chimney breast is missing, warning bells should sound. If the faintest parallel lines can be seen on the underside of the ceiling, or on the walls, it may suggest the removal of a wall.

The way the loads are transferred down the building from the roof into the ground is therefore an important aspect to understand. As the loads travel horizontally and down vertically then additional loads from floors, walls and live loads will be added. Trying to ascertain the original use of the building is therefore important, especially if your client wants to change the use. Converting large former residential houses into commercial properties may therefore bring challenges if overlooked.

Another way of helping ourselves is to use drawings because sketches and sections through buildings or parts of a building force us to think. They can be done at the property and arrows can be added to show the load path. This simple exercise alone will often prompt us to go back to look at something again, hopefully before we have left the building and may highlight other alteration works that are not obvious.

The vast majority of buildings do not fall down. If we are comfortable with the notion that we know why they fall down, equally important is knowing why they do not. Getting to grips with this is therefore hugely important, and my thoughts are that this should be done before the main inspection begins. Sometimes, we compile lists of defects methodically referenced

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to external elevations or internal rooms and floors – yet if asked whether the building was concrete or steel frame, sometimes the answer is we don't know, because we did not stop to find out.

Understanding materials as part of this process is crucial. Timber is extensively used and performs well, but can be overstressed or (more commonly) allowed to get wet. Understanding the moisture threshold for timber is therefore important, as well as knowing that if the dampness is remedied it will dry out and the timber could remain in use provided its strength has not been compromised. After first installation, concrete shrinks as it dries and clay bricks expand as they first take up moisture, so seeing the two together will raise a number of issues that need to be checked on site; for example, the way in which both materials have been designed to accommodate this movement and the location and frequency of vertical and horizontal movement joints.

Knowing the form of construction and materials use are therefore of great assistance when looking further for defects. With the knowledge that a building has a concrete frame, or concrete floor or roof beams, a number of questions should immediately arise. What does a section through the concrete look like? Draw it, then consider where the reinforcement should be (i.e. how much cover the reinforcement has) and with the knowledge that it might corrode and expand, go back to look for tell-tale cracks or staining. If any staining is random, could it be the reinforcement or iron pyrites? Following this, consider other possible issues with concrete products, some of which may require samples to be taken and tested, such as carbonation, the presence of chlorides or the use of high alumina cement.

Act and react

Recent years have seen advances in the use of adhesives, composite materials, insulating and cladding products, but more research is sometimes required to understand how these materials behave or react with one another. The general principles of gravity and friction (coupled with the nails, screws and mortar holding a building together) may seem remote if non-mechanical means are used but we should still understand them. Workmanship and attention to detail is therefore important, as are the principles of how the building envelope is waterproofed and how it is attached to the substructure or frame. An understanding will raise important questions. How are the products held in place if there are no obvious mechanical fixings? How does the envelope discharge its water and where is the water path? Where might be the points of weakness in the water path that may need closer inspections?

I often ask surveyors to imagine undertaking a survey of a large industrial unit, on a warm summer's day, on the day of completion. We write down the things to look for, and then I ask them to imagine the same inspection, undertaken in the pouring rain, in the middle of winter five and 10 years later.

To be able to project a building forward in time is a frequent challenge. How will this material perform? Will this product stay clean? Are there enough movement joints? Are there enough rainwater outlets? An awareness of how materials perform is clearly important and, coupled with understanding the form of construction and a few sketches, will greatly assist in answering these questions.

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