

# Digging deep

In the second part of his article, Andrew Bussey explains how, using a structured approach, surveyors can diagnose subsidence movements

Recently (*Building Surveying Journal*, October 06), I wrote about the different schools of thought when administering subsidence claims. We touched upon the approach of undertaking traditional investigations and diagnosis and compared this to the alternative of a desktop study, using data held on properties throughout the UK since subsidence was first investigated in the 1970s.

All building professionals know that, to come up with a comprehensive solution to a defect, the first stage really lies in identifying its cause.

The desktop option only has applications where the individual assessing the problem is extremely confident they know what the cause is and, if not, they will usually revert to investigations to help establish this.

## Take a look

The first stage is establishing the type of damage that has occurred and what patterns it suggests. There is really no option but to take the time to walk around all areas of the property internally and externally, plot the movement on hand drawn plans and elevations and to then take stock of this information to try and identify the parts of the property that appear to be moving. From this, it will be clear whether or not the damages do relate to a foundation-related problem or floor, wall or roofing defects.

A further tool to help identify the focal point of movement is the completion of level surveys throughout the building. A spirit level placed on various surfaces will help identify areas where the building has moved. A more comprehensive means is to complete a level survey of damp-proof course height using

a simple 'dumpy' level. On the assumption the damp-proof course was laid relatively level, any distortions to this will help identify where the foundations may have dropped or lifted.

If all the symptoms do suggest foundation movement occurring, this doesn't instantly mean it's a subsidence problem. This has a very precise definition (such as "Downward movement of the ground beneath a property foundation"), which insurers are keen to ensure is correctly used as their policies usually cover subsidence movement, but often not other types of foundation-related movement.

Subsidence obviously differs from heave, settlement and landslip and the Institution of Structural Engineers' provide clear definitions in their domestic subsidence guide.

To distinguish between the different types of movement, an interview with the building owner is very useful to establish information such as: when were different parts of the property constructed?; what materials and techniques were used?; when did they first notice the problems were occurring?; and is there a particular pattern for the cracks opening, closing, stabilising or becoming progressively worse?

## Get digging

As part of an initial appraisal of the damage, following the above process through should help establish whether or not this is a genuine episode of subsidence movement. The next stage is to consider investigations to try and prove this and establish what the precise cause is.

The excavation of trial pits is usually essential to this at both the focal point (or points) of movement, and also in control



Foundation Movement cracking – diagonal and tapering in width



Movement to panelling suggests foundation movement



Steps moving due to ongoing compaction of fill material not subsidence – trial holes were critical in proving this



Expansion/contraction cracking – not to be confused with foundation movement

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Sometimes internal trial holes are necessary to establish the cause of movement



This property was found to be underpinned incorrectly which was the cause of the foundation movement



Trial holes at this property revealed the presence of made ground enabling ground movement

## “If all the symptoms do suggest foundation movement occurring, this doesn’t instantly mean it’s a subsidence problem”

areas away from the movement for comparison reasons. This will enable the foundation type and depth to be identified and also the nature of the underlying subsoil, which can vary significantly in short distances across even the smallest of sites.

### Foundation issues

The surveyor will then be able to identify whether or not the foundations are all the same depth, the nature of the underlying subsoil, its strength and qualities and the presence of any unusual features such as tree roots, evidence of made ground, standing water, voids, etc.

The majority of subsidence claims relate either to differential shrinkage of clay-based subsoil, climatic changes and/or vegetation roots, and also defective drains causing subsoil to soften and lose its bearing capacity or alternatively erosion of granular-based subsoil. From the trial hole, these causes should be fairly easy to identify.

It is however, sometimes useful to obtain subsoil samples from the trial holes and for laboratory analysis to confirm their composition and establish their plasticity indices, moisture contents and liquid limits.

In clay shrinkage cases, this work is often essential where third party or protected species of vegetation are involved, to

demonstrate to other parties that the subsoil has indeed been dried out and affected by the presence of the vegetation. In these cases, it is frequently necessary to obtain root samples and also for laboratory testing to establish whether or not the roots are alive and having an influence, and also the species from which they emanate to try and identify their source.

In cases where the subsoil below the foundations looks to have eroded or softened and is wet, the obvious potential causes are leaking drains or leaking water mains.

On the latter, pressure tests can be easily undertaken on water mains to establish whether or not there is leakage in the system, but this does not always naturally identify the precise point of any leaks. Drainage companies using CCTV cameras are able to assist with drain examinations on subsidence claims, but it is important they have an accurate brief before going to site. In diagnosing subsidence, we are interested in the depth of the drains, their falls, their construction, condition, water tightness and the likely causes of any defects.

Where insurers are involved, they will be particularly interested to know whether there are inherent shortfalls in the way the drains were constructed, but if

accidental damage is deemed to be the cause of the defects, there is a strong chance they will be happy to fund the repairs involved.

The above represents a relatively typical range of initial subsidence investigations that are usually adequate for the precise cause of the movement to be identified, and from this, mitigation works can be established to remedy the problems.

However, in more complex cases, the investigation works may not lead to an obvious cause and further involved works may be necessary.

### Boring can be good

It may emerge that some initial monitoring of the building is useful to try and establish if there is a particular pattern of movement. Studs fitted to cracks are useful in this regard and level monitoring pins fitted around the building’s damp-proof course will also help indicate this. The accuracies of such monitoring regimes hinge on the frequency of the readings, and bi-monthly intervals are widely accepted by the industry as an acceptable period.

That said, digital systems are now being piloted that will remain permanently fixed to buildings to enable a constant record of movement without the need for technicians to regularly visit the site.

It may emerge that there are deep-seated problems below the

site, and a further diagnostic tool is the completion of boreholes to consider what is going on at greater depth. This will identify any inherent problems with the ground and possibly any evidence of swallow holes or mine workings.

It is also often useful to arrange a visit to the local archives office to try and establish the history of the site and what existed there previously. British Geological Survey Sheets are also useful in this regard.

The above describes some of the comprehensive investigation techniques available but, in the majority of cases, only basic investigation works are needed and in some cases can be completely avoided by the use of desktop assessments.

There is really no better way than for the surveyor to use their senses and construction training to establish the type of movement occurring, find its focal point and then identify appropriate investigations to establish its cause and repair works.

### References

<sup>1</sup> *Subsidence of low-rise buildings*, The Institute of Structural Engineers, August 2000

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