Stopping the slide

In his third article on subsidence, Andrew Bussey looks at mitigation and repair works

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Needle beams can be used as part of an underpinning scheme

Generally, subsidence is attributable to shrinkage of the underlying subsoil, a problem often caused by climatic conditions and vegetation roots. Defective drains are also heavily involved in subsidence claims as they cause subsoil to erode or soften. Causes can often be easily identified and the first question the surveyor needs to ask is: "What can be done to prevent this from having an influence in the future?"

If the foundations of the building had been previously operating successfully, removing the cause will potentially restore them to their former condition and, hopefully, they will continue to be structurally sound in the future.

With vegetation, questions need to be asked on whether or not this can be removed or reduced to minimise its influence. Typical issues encountered are vegetation ownership and status. If there is an obstructive neighbour or local authority, surveyors will usually be asked to prove beyond doubt that the vegetation is an influence before mitigation works are undertaken. Reviewing the investigation stage of a project is therefore often important to obtain soil tests results and root analysis to help demonstrate this. It is also important to start any monitoring works early to help show there is an active pattern of movement. The surveyor should start an early dialogue with neighbours and the local authority to explain the nature of the problem.

Depending on the age of the vegetation and the buildings, it may not be appropriate to instruct removal or maintenance works as these may have an adverse heave effect on the foundations. It's often the case that stabilisation techniques need to be employed.

Regarding leaking drains, if the subsoil has been softened by a defective system, repairs to the pipework may result in the soil stability being restored. Where erosion has occurred, drain repairs should be undertaken as part of good property maintenance, but they will not restore a foundation's stability and alternative methods do need to be considered.

If a problem can be treated, the first port of call available to the surveyor is to restore stability and these works should be performed without delay. In particular, vegetation works need to be undertaken before the start of the next growing season.

Check the success

When mitigation works have been undertaken, their effectiveness should be assessed, and crack and level monitoring undertaken at regular intervals to provide a reliable means of measuring their success. The days of glass tell-tales to assess movement are long gone and digital calipers and stainless steel studs are now able to provide more accurate recording methods. At present, these systems rely on technicians visiting sites, but systems are now being developed where stability at damp proof course height can be reviewed remotely using level sensors and mobile communications. As these systems are efficient and technician involvement is reduced, monitoring costs should fall.

With drain-related claims, it is usual to monitor remedial works for approximately four to six months to ensure their success, and with shrinkage related claims, it is sensible to monitor until the following autumn to assess the influence of the dry summer months. Surveyors should not assume that mitigation works will be a success.

If stability prevails, the building can be repaired using relatively cost-effective cosmetic methods. Many products are now available to the subsidence surveyor to reinforce bed joints where cracking has occurred and to enable repairs to plaster that eliminates the chances of cracks recurring.

Stablisation techniques

It may be that after the investigation stage there is no causal factor that can be easily treated. For example, if the building has been constructed on made-up ground, which is liable to compact and consolidate, little can be done to prevent this and monitoring will simply help prove it. Here, there is no option but to move towards more involved and often more expensive stabilisation techniques. Even after a period of monitoring on simple cases, if ongoing movement is recorded, these techniques may need to be employed.

The obvious options are underpinning and the technique depends on existing ground conditions. Traditional mass concrete systems are best suited to shallow depths for cost and health and safety reasons. Where greater depth is needed, the use of beam and base underpinning and piling is usually more appropriate and often results in better value and a tighter contract programme. Critical when designing any underpinning solution is understanding the precise cause of a problem and more detailed site investigation works may be needed.

With this information, the surveyor will be wise to talk

to specialist underpinning contractors to gauge their views on the most workable scheme. For example, there's little point in planning a deep mass concrete scheme if contractors aren't comfortable with the health and safety implications, or scheduling a piling scheme if the rig can't get to the area. Early dialogue with the property owner and their insurer is essential as these techniques can often be disruptive, requiring property owners to temporarily relocate.

Other techniques more readily employed are tension 'belts' to brace the property foundations together as one unit. This won't prevent the foundations from completely moving but will ensure the building moves in one piece without cracking. Systems also exist to jack foundations back to position to restore the building's alignment.

Gain permission

As with any repairs, questions should be asked regarding whether or not any statutory consents are required, in particular concerning Building Regulations, and early dialogue with the local authority is recommended. Underpinning works are deemed structural repairs and hence building control officers need notifying. Furthermore, repair works, and especially excavation close to boundary lines, often brings into play the Party Wall Etc Act and surveyors need to ensure notices and awards are prepared before starting on-site work. Delays do arise when notices haven't been served and adjoining owners may want to exercise their party wall rights.

Perhaps the best way to demonstrate the various stages of mitigation and remedial works is by means of an example.

A 1970s bungalow that had been extended to its rear experienced cracking following the dry summer of 2003. The insurer's brief allowed us to excavate trial pits to the property's perimeter and this revealed the building was constructed on concrete foundations around one metre deep and below this, there was a thin layer of clay before hard impenetrable rock. The subsoil below the foundations in the affected part contained tree roots and laboratory analysis confirmed it was desiccated. This looked like a simple clay-shrinkage case and over the following months (with the assistance of laboratory test results, root analysis and the input of an arboriculturalist) we were able to convince neighbouring property owners that their trees were responsible and they subsequently arranged for these to be removed. Crack monitoring was then carried out but despite the vegetation works, the cracks did not show any signs of closure and stability, and instead continued to open.

Further cracks appeared, and insurers accepted our recommendation that further deep-seated investigations were needed and, using a specialist borehole company, we were able to establish that the hard impenetrable rock seam was in fact only around 150mm thick and below this was made ground (consisting of clay, boulders, bricks and concrete waste). We were anxious to establish the reason for this unusual feature and visited the County Archive Office. We established the area to the rear of the bungalow had been used as a quarry until the 1950s and this had been backfilled to enable residential development.

While the main house had been unaffected and was seated on reliable subsoil, the rear extension was formed over the former quarry area and, although this clay-based backfill had suffered from a degree of shrinkage, it was also compacting and consolidating causing the ongoing movement.

From the borehole data, we were able to design piled foundations to reinstate support to the building's foundations and cosmetic repair works were then possible.

This case emphasises the need for as thorough investigations as possible and monitoring the situation after mitigation works have been undertaken. If monitoring hadn't been performed and the repairs immediately implemented, insurers would have been faced with duplicate cosmetic repair costs that far outweighed the relatively low costs of the monitoring regime.

The biggest lesson is to take each case on its merits and understand the facts as they gradually emerge – don't take the success of mitigation works for granted. This will ultimately enable the property to be appropriately repaired and its value and condition restored.

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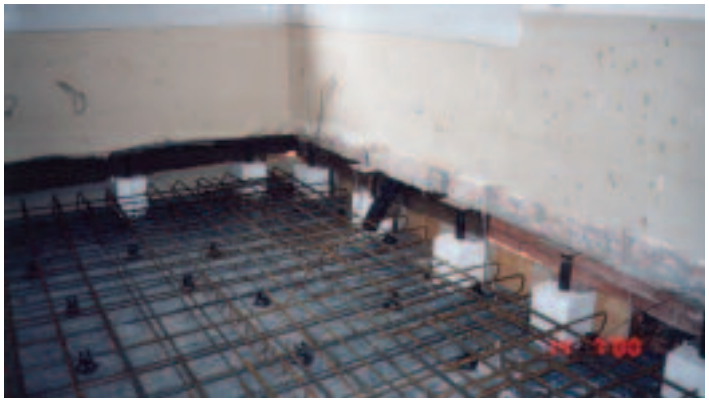

Introduction of a piled raft is one method used to stabilise a property

Some piling rigs are small and manoeuvrable for when there is restricted access or low headroom