

Building subsidence

A seasonal hazard

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Building subsidence is a perennial problem for many home-owners and builders alike. Every year hundreds of millions of pounds are spent in remedial works and compensation, and properties are devalued, sometimes unnecessarily, as a direct result of subsidence. The causes of subsidence include the shrinkage and swelling of clay, mining, dissolution, and metastability. However, of these the most significant in terms of extent, frequency and total cost is clay shrink/swell. In Britain, the most vulnerable areas are in the south-east and Midlands of England where younger geological formations, such as the London Clay and the Gault clay, predominate. Not all clay formations have the same susceptibility to shrink/swell. This is largely dependent on the particular mineralogy of the clay. This in turn is dependent on the original rock material from which the clay minerals were formed, and the age and post-depositional history of the clay formation.

Whilst the underlying causes of clay shrink/swell are the respective loss or gain of water from the soil and the susceptibility of the clay minerals, the actual ground deformations beneath buildings are also a function of rainfall, temperature, drainage, foundation type and depth, building materials, nearby vegetation, and soil structure. Clay shrink/swell can be exacerbated by the addition or removal of trees and by leaking pipes. Specialist structural surveyors are able to calculate the precise triggering factors of shrinkage, or swelling, or to identify causes other than shrink/swell, from the type and disposition of cracking within a building's floors and walls.

Research is under way at the BGS into new methods of measuring 'shrinkage limit' in the laboratory. Currently, this

parameter is seldom determined because the test requires the use of mercury, a hazardous substance. The 'shrinkage limit' defines the water content below which substantial shrinkage ceases. The lower the value of the shrinkage limit the greater the range of water contents over which a clay is able to shrink. The test also defines an important part of the shrinkage vs. water content curve, characteristic of the clay. Also, the BGS is contributing to a new research programme using satellite-borne radar interferometry (InSAR) to measure the seasonal change in ground level of the London Clay outcrop attributable to clay shrink/swell. These projects are at opposite ends of the research scale, but each will contribute to a better understanding of shrink/swell susceptible

materials and a means by which they can be identified and quantified. There is also close collaboration between the BGS and the National House Building Council who deal nationally with the consequences of clay shrink/swell to individual homes covered by their guarantee scheme.

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The opposite of shrinkage is swelling, that is, an increase in the volume of a clay due to the take up of water. Swelling might become a problem following flooding after a long dry period, or as a result of a leaking water pipe or sewer. The swelling process tends to affect the same clay formations as shrinkage, but the effects on a building are different, though equally damaging.



Diagonal crack in new terrace due to swelling of London Clay along former hedge-line, Vange, south-west Essex.