

# Subsidence in the Chalk

## Using seismic tomography

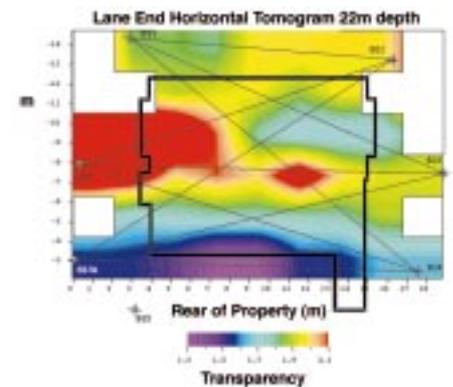
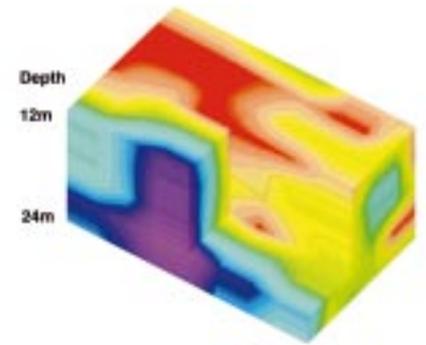
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Subsidence over the period 1993 to 1997, at the rear of a property near High Wycombe built in 1830, resulted in substantial cracking of the masonry structure. In order to design remedial measures, knowledge of the extent of disturbed ground beneath the dwelling was necessary. Cross-borehole seismic tomography was identified as the most suitable means of assessing the ground beneath the property without disturbing it.

The subsidence occurred in ancient river deposits (sands and clays of the Reading Formation) overlying chalk (Upper Chalk). Previously, when exposed, the Upper Chalk was dissolved by

rainwater, resulting in a highly irregular topography into which sediments were subsequently deposited. Conical sinkholes with a central pipe, shaped like a 'tornado', are typical dissolution features encountered in the Chalk of southern England. These features continue to present a hazard today because, being filled with loose deposits, they are susceptible to further settlement and collapse, particularly if drainage patterns change (often induced by man).

During the geophysical survey, sound was propagated between pairs of boreholes, a source being in one borehole while multiple detectors were in the other. The source and detectors were moved such



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Seismic tomography identified an 'opaque' volume of ground (high attenuation) to be associated with the subsidence and to extend under the rear of the property.

that all possible ray paths (at one metre spacing) were acquired, providing a complete, 'criss-cross' coverage of the plane between seventeen pairs of boreholes. The site, close to a busy road and generally heterogeneous in nature, provided challenging conditions requiring the use of a high power BGS-designed seismic source. It was found that the ground associated with the subsidence was almost 'opaque' to the seismic signals. Consequently, amplitude of the received seismic wave (rather than time of transmission) was used to assess the extent to which the ground under the property was affected by the subsidence.

The results showed seismically 'opaque' ground (blue) to extend under the rear of the property to a degree that implied the ground under the house was likely to subside. The outcome was that the proposed remedial measures were deemed to be too expensive, and a new solution was formulated.

Main photo: *The Old Vicarage built in 1830.*

Inset photo: *Cracks in external masonry.*

